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Paradigm Shift to the European Business Model. Extreme Light Infrastructure – Nuclear Physics Project. Study Case

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Abstract

The multipliers of paradigm shift in economy are abundance, change of micro and macroeconomic equilibrium, and increased intensity in creativity at the level of economic processes. Authors starts from the hypothesis that in the field of economics and business, a number of enthusiastic approaches to paradigm shift must be taken with some reservations as functional market have their specificity, the public choice logic is very well represented, the idea of social learning is present more than in other fields and the principle of economic rationality has great applicability. The most important characteristics of the new European industry are: is based on three pillars: strong educational system, scientific research and high-tech; advanced research is an integrative industry; the results of the advanced research are an Open Source. The analysis is based on the quadruple helix logic, authors analyzing the Extreme Light Infrastructure - Nuclear Physics (ELI-NP). As development of a country could be based on few advanced research projects and it is possible to use this experience for the whole region, new engines of the European economy, will be: nuclear research, extreme intensity light research and astronautics, the new industry will develop a large range of activities and jobs which will modify the labor map and the relocation of large companies to Europe will be one of the concrete result of the stimulating the advanced research.

Keywords: Paradigm shift, business model, infrastructure, technological challenges

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1. Introduction

Kuhn [1], defined scientific paradigms as "*accepted examples of actual scientific practice that include laws, theory, application and instrumentation that provide models from which particular coherent traditions of scientific research springs*,,. An analytical vector that is frequently found in the process of conceptualizing the paradigm shift has become the most efficient market. The plans for analytical and methodological clarification of this paradigm were macro and microeconomic, each of which allowed some epistemological and praxiological nuances and detachments of great subtlety. The most difficult

was at the level of academic and economic and social experts, the consensus on the importance of the uncertainty and the rational behavior of the economic actors participating in the functioning of the market. A feverish debate on this issue is fueled by trying to answer the question - to what extent is humanity prepared to accept the paradigm shift? The analysis of the specialized literature allows us to take note of the views that economic modernity has consecrated two main changes of dominant logic. The first was the transition from the philosophy of laissez-faire consecrated by the physiocrats and later by Adam Smith [2] to what was called the "*post-war consensus*" when maturity of Keynesian philosophy. The second phase of substantive transformations in economic science began in the 1970s, when attempts were made to provide the right answers to the various macro and mono-economic turmoil, continued in the 1980s, when the economic policies specific to the free and functional market and exploded neoliberalism and continues to the present with the harsh nuances. It is also very interesting how analysts have endeavored to explain the conditions in which paradigm shift becomes necessary. The abundance must be perceived as a process of mitigation of the rarity of some essential resources for economic evolution. The subject of the scarcity or the abundance of factors is a well-known topic in the theoretical scientific field of the development processes, became support for some of the most common and appreciated theories connected with the economic development and specialization of the production and commercialization. The topic become very interesting in last period when the economic life is facing to very complex challenges in special to the transition to creativity-based economy. In a more turbulent business environment one need to reflect to other categories of factors and to another perception of the correlation between available resources and the objectives in the development strategy. It is justified to say that in this very moment the consumers are more interested in getting different levels of satisfaction than to buying products and services as a target in itself.

That is why, under these new conditions, all actors involved in the economic game have to understand that the macroeconomic and sectorial balances change, that we have to deal with another relation between supply and demand and that is becoming operational another panel of factors of production. Even more exciting are exchanges of ideas on the concept of paradigm shift. In the most general way, this means no longer measuring wealth in terms of gross domestic product per capita but in terms of prosperity, expressed by the level of happiness showed by individuals in a particular societal context. This context obliged us to be less attentive to figures and more and more attentive to other determinants such as "*rising aspirations, relative income differences,*

and security of gains become increasingly important" [3]. A topic of great interest in recent times is the emergence of new powers in the economic and technological sphere, leading to redesigning the scale of competitive advantages and provoking the traditional roles held by the current great powers. The new global economic forces, such as China, India, Brazil, Indonesia, are putting more and more courage on the top places in the international competitiveness charts, they record the highest growth rates at the economic level and provide us with increasing percentages of young people who follow the most famous universities and accumulates the latest skills in new technologies and industries based on creativity or working in the world's most famous research centers. Some analysts [4] bring more and more complex issues into the reflection landscape, underlining that "*there is no invention in business or technology without human consciousness*". One need to take into consideration that raising public awareness will produce sustained societal effects at least in the following ways: the emergence of values - driven consumer; emphasis on spirituality and meaningfulness to the business level and socially responsible investment. In the same analytical line, it becomes increasingly obvious that it is not enough to identify threats and opportunities and to argue, but it becomes mandatory to say "their success story".

In this paper we highlight the extent to which the main characteristics of the shifting paradigm process can be found in the equation of the dynamic correlation between highly relevant scientific research and the communication of its results to society in order to give value to advanced ideas. An important role will be given to the role of various means to creating a high level of awareness of the state of advanced scientific research and the rapid dissemination of great ideas that can take the form of innovative economic processes, a range of original products and services and a new relational diagram among societal actors.

The current business paradigm is increasingly tied to the emphasis on individualism and the many controversies over network regulation mechanisms. The current European business environment is defined by the fact that it involves a societal landscape in which the economic actors have as a venue the entire planet where they carry out integrated activities, involves the aggregation of different economic activities in integrated chains of activities (vertically and horizontally) and potentiates the transition from the concept of concentrating economic activities into increasingly larger production centers, deindustrialization and networking. One of the more pressing challenges faced by the current paradigm of the business environment is ethical, exacerbated especially by the growing and complex scandals that have occurred over the last decade. Attempts by the corporate environment to identify niches through which they can slip in order

not to fully comply with the rigors of economic legislation in general and tax law in particular have raised another dilemma about the true legitimacy of actions taken and the appropriate compliance policy. In the context of a new business environment paradigm, all categories of externalities, especially the negative ones, associated with the current model of economic development, will have to be taken into consideration more and more seriously. If in the process of estimating the level at which economic growth is to include at least the most pressing negative externalities (especially those in the ecological, social and technological terms), the results will be surprising, far from those obtained under the conditions in which they operate with a series of sunk costs. It is increasingly evident that a new business paradigm cannot be imagined without the business being able to understand and accept that success must be built on long-term horizons and taking into account the costs that are ignored under the current business model.

The most important characteristics of the new European industry are: is based on three pillars: strong educational system, scientific research and high-tech; advanced research is an integrative industry; the results of the advanced research are an Open Source. The analysis is based on the quadruple helix logic, which enables businesses to draw on expertise from outside their operations to develop new products, services, and ideas. In this paper, we stress the fact that advanced research is the most important user of the latest technology and an advanced research project with international impact will represent the most important engine of national and regional economy. We have analyzed the Extreme Light Infrastructure - Nuclear Physics (ELI-NP) where international scientific community has the possibility to characterize the "deep matter" to map the "deep space" whose pillars are: Attosecond Laser Science; High Energy Beam Science; Laser - Induced Photonuclear Physics; Ultra High Field Science. Our conclusion is that it is important to make a correlation between the large-scale scientific infrastructure in the nuclear and laser field, which develops their own Knowledge Transfer Gate in Europe and the media as a promoter of ideas and business opportunities.

1.1. The main pitfalls of paradigm shift process

Analysts belonging to different scientific fields have used specific ingredients to describe the same realities and, for this reason, the definitions for the paradigm or the paradigm shift process are very numerous. There are frequent debates about the necessity to shift the actual economic paradigm, even though this process is not very sharp understood. The starting point in the epistemological process could be

considerate the year 1962 when a well-known expert [1] wrote that a paradigm is,,a set of assumptions that allows scientists in a particular field to avoid time-wasting arguments over the basics and spend their days solving small but useful puzzles,,. Kuhn pointed out that, "change occurs when two conditions are met: first, a critical mass in the number or importance of ``anomalies" that contradicts the dominant paradigm, and, secondly, the successful development of an alternative theory that better explains the prevailing evidence". Baker [5] considered that o paradigm is ``*a set of rules and regulations that establishes or defines boundaries and tells you how to behave inside those boundaries*". Other experts [6] developed a very creative type of paradigm underlying that,,...we're progressing yet again---to a society of creators and empathizers, of pattern recognizers and meaning makers where the greatest employment gains are made though small business."

Starting from this assumption, another analyst argues that the transformations expected in some sectors of the economy require ambitious scientific research programs, arguing that "progressive programs advance new theories and adopt ideas that better explain reality. In contrast, degenerating programs persist with old theories and ideas, despite their failure to explain the available evidence, and eventually abdicate their previous status as progressive programs." From this perspective, paradigm shift begins when "progressive programs gather sufficient support to overcome the hold of a degenerating program and a tipping point is reached, after which the old program is superseded." In the field of economics and business, such postulates need to be taken with some reservations as we must remember that functional market principles have their specificity and generate both success and failure that public choice is well represented, is more present than in other branches of science the idea of social learning and the principle of economic rationality. Hall draws attention to the fact that "economic policy can show three" orders "of change, increasing in their magnitude: adjustment of an existing policy, change in policy and change in the goals of politics altogether".

Some analysts [4] bring more and more complex issues into the reflection landscape. One of these is that of "public consciousness" that insinuates itself in the defining correlations of the new economy and significantly changes its design. This author argues that "there is no invention in business or technology without human consciousness," insisting that raising public awareness will produce sustained societal effects at least in the following ways: the emergence of values - driven consumer; emphasis on spirituality and meaningfulness to the business level and socially responsible investment. Another analyst [7] brought to the analytical landscape a new type of economic paradigm that

has at its core a process by which *"Replace utility-maximizing economic man with a Darwinian fellow who simply wants to do better than the next guy*" and "*Let this selfish creature fight it out in a macroeconomic model based on the circulatory system*". In the same analytical line, it becomes increasingly obvious that it is not enough to identify threats and opportunities and to argue, but it becomes mandatory to say "their success story", which leads us to what Pink [6] postulates, namely, "*It's not enough to create a product, a service, an experience, or a lifestyle that's just functional. Today it is economically crucial and personally rewarding to create something that is also beautiful, whimsical, and emotionally engaging*"

It is recommended that the process of understanding the context in which the paradigm shift can occur is broken down into the following elements: ``*its intellectual and academic underpinning, especially within economics; the discourses and narratives through which it was expressed in the broader public domain; the political policies and processes - notably the elections of governments - which enabled it to be implemented*''. [8]

The unifying analytic vector for the approaches to this area of economic science was multidisciplinary, diversity deriving from the angle of approach used by major schools of thought in this thematic area. It was noted as a step forward in relation to both the neoclassical approach and the German ordo liberal approach, Milton Friedman's monetarism, but also the theory of the economic behavior of the agents of change that brought into the analytical arena the tools referring to rational expectations, game theory, public choice theory, regulatory capture, and an ecosystem of people, networks and institutions. The neoliberal ideas, left from the academic creation laboratories, migrated to the most diverse layers of society, being taken over by political doctrines, public policies, or economic strategies. This process has both different speeds and amplitudes in the US or Europe, allowing for numerous comparisons between the precepts and the driving effects produced by the implementation of these new ideas.

Gradually, the public's attention was drawn to the ideas that prompted greater involvement of the state in the economy, a redefined balance between the two components of what analysts called "inseparable ops" (the functioning market and the government's intervention in the economy) much the subject of the debate on what is meant to be "the third way". It has been insinuated in the epistemological landscape and the idea of the operation of an altered paradigm, arguing that an alternative to persistence in the same paradigm that shows its vulnerabilities may be the use of a modified one, especially if the prerequisites of changing the existing paradigm have not been created. The phenomena of the crisis facing the world economy in the last two decades of the

20th century, especially those of magnitude that have occurred since 2008, raised serious questions about this "crash" and have signaled the need for a paradigm shift. The moment of truth was the outbreak of the greatest economic and financial crisis known in modern society. Returning to Keynesian schemes alongside drastic economic austerity programs have been seen as solutions to the economic turmoil, but have further highlighted the urgency of paradigm shift, especially when it comes to the prevalence of the sector tertiary to the quaternary. In a new paradigm, the foundations for mitigating income inequalities, diminishing the frustrations that have accumulated in modern society, eliminating the negative effects of globalization will have to be created in order for its benefits to be visible, to ensure sustainability at both macroeconomic and corporate level, consisting of economic efficiency, social responsibility and ecological sustainability.

There are significant signs that we are already in the incipient phase of a new paradigm, even if this truth is recognized or not. If we analyze the economic policies of governments, especially those in industrialized countries, the doctrine of representative scientific schools, university studies programs and even civil society platforms, we will find that the switching process has not started from a dominant logic so far one specific to the beginning of the new millennium. There are also some good moves in this direction, especially at the rhetorical or narrative level. Among these, we can mention the topics of debate discussed by the major academic centers, the topics for which the Nobel Prize for Economics has been granted lately, or the increasingly frequent criticism of the neoliberalism philosophy. Despite these societal messages, we must point out that there is no solid alternative to the increasingly criticized realities, and we cannot talk about setting up a firm process of paradigm shift. Such a leap in the economy must be carefully considered and analyzed with high level of rigor. A change of paradigm involves the simultaneous fulfillment of several requirements: changing the overall perspective of the economic picture as a whole; the radical change of the regulatory and institutional framework, as well as the substantive transformation of the behaviors of the societal actors. Only modifying the regulatory and institutional framework, even if this process is wrongly referred to as reform, is neither sufficient nor productive of palpable results.

There are some metaphorical perspectives of paradigm shift according with it will be necessary to review the relevant correlations between the various sectors of the economy, with a particular emphasis on the one between the real and the financial economy, the authentic causality relations between the phenomena and the processes, on the one hand and between their determinants and the effects of certain developments,

on the other. The dissatisfaction with the fundamentals of the prevailing paradigm over the last several decades has been expressed in many ways and by the most authoritative voices. It may be mentioned Paul Krugman who, in a lecture held in 2009 at the London School of Economics [9], said that "*most work in macroeconomics in the past 30 years has been useless at the best and worst*." With the advancement of the new millennium, they are seeing the fastest and most profound transformations in the face of contemporary society. One of the segments that give us the greatest surprises and forces us to manage another type of challenge is the technological advancement fueled by the speed at which it produces and the dissemination of advanced knowledge. It is the context in which the economy based on creativity advances, whose laws are to a great extent different, and the speed of adaptation must be rapid, far-reaching and especially correct.

A new paradigm of sustainable development emerged in the late 1980s, its supporters attempting to set up an epistemological and praxiological framework with which to put the strategic objectives of economic growth, social welfare and protection in a synergistic manner of the environment. After nearly 30 years, more and more people have been convinced that this desideratum is unlikely to translate into practice. Steffen et al. [10] argued that "*four out of nine planetary boundaries have been crossed: climate change, impacts on biosphere integrity, land-system change and altered biochemical flows are a manifestation that human activities are driving Earth into a new state of imbalance*". Reality also shows that we are witnessing a deepening of social inequalities, questioning the legitimacy of public institutions and large private organizations, and at the simultaneous entrance into crisis of all three pivots of sustainability - the environment, society and the economy. In an attempt to identify the appropriate type of economy we are contemporary with, several authors have called for the emergence of concepts such as "green economy", "blue economy" or "orange economy". Against this background, there is growing talk of economic de-growth, considering that a "*contradiction between sustainability and economic growth*" can be identified [11, 12]. For a long time, the desires for economic development, along with the paradigms defining it, have been fully accepted in the entire world, whether developed or developing. With all the claims of rigor and accuracy in terms of analytical criteria and instruments, all of the new economic categories presented only part of the reality they were proposing to express, suffering from instrumental and methodological asymmetry. The portion that seems to be permanently omitted from the economic growth equation was that of the environmental and social costs of the traditional development model. There are analysts who argued that the political dimension of development processes was not properly

included in the econometric models with which economic growth was forecasted, and the factors on which it depends are surprised. Some more recent contributions have raised the issue of economic development, drew attention to the need to take into account the legitimacy of defining processes for economic development, and have raised the issue of management, both public and private. [13]

A topic to which economic research should attach more importance is that of the type of society (and within it, of the type of sustainability) that should be imagined and built. [14] An area of high sensitivity debate is related to the correlations that need to be pursued multiparametrally between sustainability, economic progress and the society we are headed towards. Some analysts [15] advocates setting up a new vision of social and ecological changes. In such a new vision, the traditional clashes, the rankings in which world states are placed, the typology of the basic sectors of the modern economy, the qualifications and skills, the ages of technological concentrations or the attitudes towards what innovation and originality are. It gains increasing relevance in the science-based paradigm of growth, which places on another plane the ecological and sociological limits of economic growth. The paternity of the de-growth concept is attributed to Andre Gorz who, as early as 1972, has spoken of what was fashionable at that time and expressed through the famous Meadows Co-operative Report entitled Limits to Growth Report [16] A number of doubts were expressed regarding the compatibility between the functional market economy system and the advancement of the processes of deindustrialization and redefinition of the material production landscape. A series of authors [17], [18] brought into the analytical landscape issues such as reducing consumption and promoting values like frugality, autonomy and convivial-ity. The valuable contributions to economic science brought by Nicolas Georgescu-Roegen a famous American economist born in Romania (who made us the honor to have long conversations for Radio Romania), which set the term of bio-economics that makes the match between environmental science and classical economics, have been brought to public attention, and he has firmly demonstrated that both scientific and economic evolution have a pronounced entropic dimension absolutely necessary to understand and administer. The great scientist of Romanian origin [19] pointed out that "the thermodynamic revolution should urge us to consider the fundamental element of irreversible time and the increase of entropy in a closed system." It is also the Romanian scholar who insisted to assert that "*reality can be grasped only when arithmomorphic analysis is combined with a dialectical approach, involving in particular structural and qualitative change*." The great Romanian scholar admitted that he was strongly influenced by Schumpeter's contributions that deny the reversibility in the processes

of knowledge creation by claiming that "what we are about to consider is that kind of change that originates from the system that so displaces its equilibrium point that the new one cannot be reached from the old one by infinitesimal steps" [20]. We will have to bend more cautiously of Georgescu-Roegen's important contributions to the advancement of advanced knowledge, especially those referring to exosomatic evolution that provide revolutionary openness to science in directions such as: the eventual exhaustion of the fossil and mineral resources associated with the accelerated addictions to the extravagant comfort provided by the exosomatic organs; social conflict and inequality among different societal actors. More determination is needed in the process of decoupling economic growth from material and energy resource flows in the conditions of successful promotion of economic growth that takes into account the ecological challenges and the circular economy. It must be carefully reflected in the new paradigm of sustainable development that will need to be treated more carefully and placed in the very particular conditions of a creative economy.

1.2. The challenges the new European business model is confronted with

Changes in dominant societal logic occur mainly in business, where we see the need to rethink both the business model and the improved the role of players in the market game. Answers to this dilemma are as articulated as possible, the most sensitive ones being "how to quantify and measure nonmaterial values such as wellbeing, the environment and the future? How to design an economic model that brings benefits and well-being for everyone? ". Or "Is genuine progress still possible and development sustainable?" It gains a growing recognition in the scientific environment (testified by the Nobel Prize-giving for the Economy in the Past Daniel Kahneman and Amos Tverski) contributions in terms of behavioral finance, efficient markets and neuroeconomics. For centuries it has been postulated that public policy decision-makers and private entrepreneurs should be mindful of the messages the markets are delivering and prepared to react proactively to them. Under the current economic circumstances, it is becoming increasingly obvious that, although the markets transmit many messages, it does not mean that individuals receive them in time or, if they do, accept them correctly. Depending on the societal landscape in which they have formed and manifest, even if it appears to be unified as a result of advancing the globalization process, individuals perceive different opportunities and threats that the business environment contains. Therefore, it is imperative to take more into account the cultural factor and, within it,

the focus on values and the higher corporate social responsibility. Some authors have highlighted the fact that "the company's performance is at least 30% attributable to corporate culture, the climate at the workplace, which is too large to ignore" [21] This could be a good answer to those questions linked to the need for change at the right time, with the depth that is required by the organizational chart is not an easy thing to do. Often, the solutions are not handy, cannot be found based on the experience gained and the specialized literature consulted, but they need to leave the comforting states and the crossing of disciplinary boundaries. The great scientist Albert Einstein said that "*No problem can be solved from the same level of consciousness that created it*." Under the new economy, we must learn to describe and quantify other categories of assets such as values, happiness and well-being and sustainability criteria are based on life, which is much more complex to be explained and evaluated.

The current business environment paradigm contains much vulnerability that should be corrected if it is changed. The defining paradigm for the current European business environment has been very much written. Aspects at the center of analyzes of the specific business climate of the late twentieth century and first decade of the 21st century were the continued expansion of the market economy, the growing importance of culture, science and technology, increasing interdependencies and international cooperation, and changing managerial structures and emphasizing the strategic dimension. What defines this type of business paradigm is also the almost exponential growth of cross-border flows of goods, services, capital and human resources, as well as the corresponding increase in the cross-border exchange of knowledge and information. What has less been the subject of social analytics are issues such as the social costs associated with the new type of society, the "losers" range as a result of participation in this type of business environment, threats to regional, local or personal identities well defined and the emergence of behaviors defined by reluctance and even opposition to current developments.

1.3. Extreme light infrastructure -- Nuclear physics project

At the beginning of 1962, Professor Ion I. Agârbiceanu from the Institute of Atomic Physics, Măgurele, Romania built and operate the first Romanian laser and the fourth laser in the world. In no more than 50 years, Romania changed the fourth position in this scientific field with the position No. 1 -- thanks to *Extreme Light Infrastructure -- Nuclear Physics Project*, developed by the European Union and the Romanian Government in the same location. The continuity of research in the fields of Nuclear Physics and of

Extreme Light is clearer if one remembers the fact that Prof. Agârbiceanu created in 1956 the *Laboratory for Optic Methods in Nuclear Physics*. This means that the decision of Brussels to make an investment of more than 300 million euro in the scientific facility in Măgurele was a correct one. Romania has to keep this pace and to develop in the following years all necessary decisions to stay in the main positions as a leader in this research area. Now is the moment to have a national and a European support for this approach. Following the tradition initiated by Professor Horia Hulubei, IFIN-HH addresses a spectrum of research and development activities in fundamental and applied research areas including Nuclear Physics and Astrophysics, Particle Physics, Atomic Physics, Life and Environmental Physics, Theoretical Physics, Nuclear Techniques, and Advanced Communication Systems. Featuring a variety of nation-wide-scoped facilities among which we can mention the Tandem Van de Graff Accelerator, the U120 Cyclotron, the Multipurpose Irradiation Facility Centre, the Radioactive Waste Treatment Plant, the institute is an important part of the Romanian research infrastructure. While focusing its mission on advanced investigations in Atomic and Sub-Atomic Physics, IFIN is also committed to widening the positive impact of the Nuclear on industry, other business areas, as well as on the society at large, via a diversified offer of unique professional services. Various applications of Nuclear Physics and spin-offs of basic nuclear research enable the institute not only to play the role of an active promoter of domestic progress and modernity, but also to bring a significant contribution to the public acceptance of the Nuclear. In tune with the mainstream topical research, IFIN-HH is asserting itself as a valid scientific hub in the middle of a network of spokes, in the realm of the Euro-Atlantic science and technology endeavor. A highly professional quality and proven level of performance at both individual and work-team level make IFIN-HH fully compliant with the political, scientific, and managerial requirements prevailing in the European scientific and business areas. To turn its strength to the best account, the institute concentrates its resources on along two directions: (a) to steadily develop a sound in-house capability to get and stay in the forefront of the current nuclear science and technology; and (ii) to substantively participate in the European collaborative endeavors centered on Large Scale Facilities such as GSI-Darmstadt (Germany), GANIL-Caen (France), CERN (Geneva), JINR (Dubna). This is believed to be a common-sense and mitigate strategy meant to harmonize limited domestic resources with the tall orders of the contemporary, top-level nuclear physics research, and the imperative need for Continental co-operation and integration. On these lines, over the past three years IFIN-HH has successfully participated in more than 200 national projects and in 20 international projects of the European Commission's Framework Programs 6 and 7. ELI Project is part of the

second major step in developing the New European Industry -- The Advanced Scientific Research ELI Project, in general, and ELI-NP, in particular, were included on the first Roadmap of ESFRI. The main fields of activity of IFIN HH are the followings: *Linear (tandem) accelerators; Multipurpose y-Irradiator (Sterilization and microbial control by irradiation); Detector Laboratory for CERN and FAIR; The radioactive waste processing facility; Decommissioning of the research reactor.* The main scientific programs are: *Nuclear physics experiments to characterize laser -- target int.; photonuclear reactions; exotic nuclear physics and astrophysics; QED and fundamental physics; Applied research.*

2. Methodology

The authors opted for a phenomenological research using the case study tool. The option for this methodological approach was dictated by the novelty of the topic approached, plus the relevance it has ELI-NP Project as an expression of the placement of the new European business model in the logic of the triple helix. The analysis carried out confirms that Romania is taking steps forward in the search for innovative solutions to the changes in the industrial and technological paradigm that are produced at European level, these being of the highest quality.

3. Results

To paraphrase the title of a scientific video documentary of NASA, named *Our destiny is above us!* We may say: *Our Destiny is Inside the Matter!* The Extreme Light Infrastructure -- Nuclear Physics is proving this conclusion. An advanced research project with European magnitude becomes a real economic, educational and compartmental engine for a nation. It is possible to be more influential such kind of project, well designed and properly implemented, may be a regional economic engine. We have to stress an important new reality which is not a linguistic paradox: the actual advanced research in different fields is so advanced that only the advanced research facilities may use the new technologies generated by their researchers and the few companies in the world producing for these projects. From Bell Laboratories created at the end of the 19^{th} Century in the United State of America to the Extreme Light Infrastructure -- Nuclear Physics developed under our eyes these days in Magurele, Romania there are some sensitive changes: a) scientific research became international; it is not anymore national; b) the new advanced technologies created by the advanced scientific research

are advanced that only advanced research could be the first beneficiary of them; even the defense industry needs so time to check the stability of the new opportunities. In the picture below we are presenting the **ELI-NP Technology flow chain** - Relies upon industry for implementation and generates science and tech usable to tackle challenging problems:

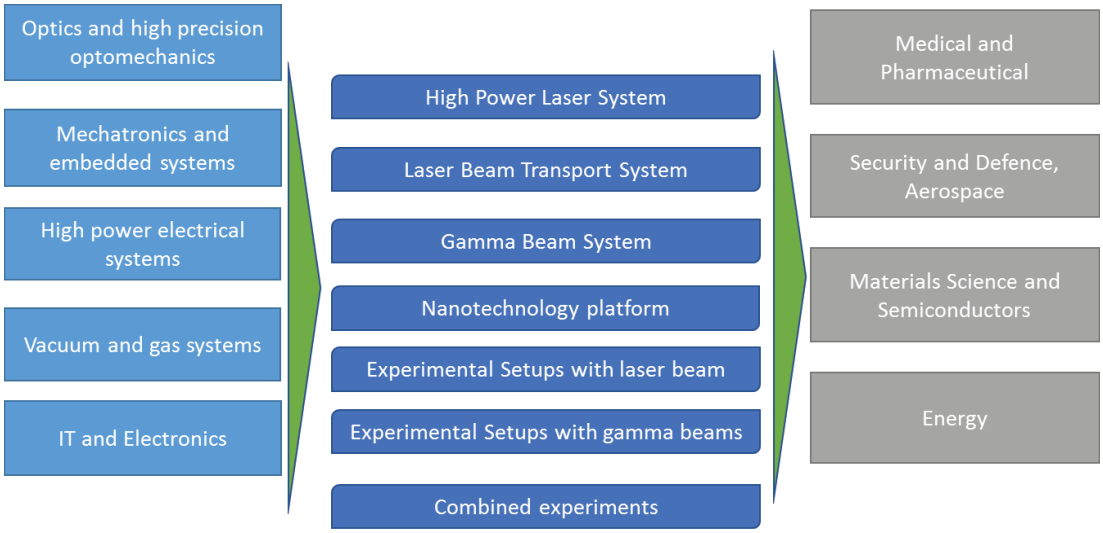

Figure 1: The ELI-NP Technology flow chain.

These are the industries touched by ELI-NP during the whole spectrum of activities from acquisitions of state-of-the-art equipment to implementation the results of the scientific advanced research. On the right side of the picture, are the main industries touched by ELI-NP during the whole spectrum of activities from acquisitions of state-of-the-art equipment to implementation the results of the scientific advanced research. On the left side there are the domains where the experiments are originated. In the middle there are the scientific instruments for research belonging to the ELI-NP facility. A traditional engine of development of a country is part of an industry and it is influencing that industry. The advanced research infrastructure project has the advantages to spread the results all over the economy, to have a strong contribution to the change of the economic development model of that country and to generate, also, a new cultural model for the young generation. We believe that a country with, at least, three advanced development research projects has a tremendous chance to have an economic boom and to use these opportunities for a real economic development.

The Magurele Facility is open to offer to the international scientific community the possibility to characterize the `*Deep Matter*` which is the equivalent of the NASA's efforts to map the `*Deep Space*`. Of course, there is a difference of size between these two large infrastructures, but they have the same final goal: to extend the boundaries

of human knowledge. There are many arguments to consider that *Large Scale Scientific Infrastructures (LSI)* is a buyer of advanced technologies based on its theoretical requests. ELI-NP was open from the early beginning of the implementation period to the public tenders for the main activities which consisted in: 1) construction of the facility; 2) ``a very high intensity laser system, with two 10 PW laser arms able to reach intensities of 10^{23} W/cm2 in a short focus configuration, or electrical fields of 10^{15} V/m; 3) a very intense (10^{13}γ/s), brilliant γ beam, ∼ 0.1 % bandwidth, with Eγ up to 19.5 MeV, which is obtained by incoherent Compton back scattering of a laser light of a very brilliant, intense, classical electron beam (Ee= 720 MeV) produced by a warm linac'' (linear particle accelerator often shortened to *linac*).[http://www.eli-np.ro/eli-np-in-a-nutshell.php] the Romanian and international companies discovered that ELI-NP started to develop a new approach of the business community: *Growing Together -- Developing Together!* This approach means to think together about a joint future of the triple helix pillars: advanced research undertakings, academic environment and business. In this landscape of performance, we can add the mass-media which can contribute to the strengthen of partnership connections. Some Romanian authors (Șeuleanu, D and Diaconescu, B, 2016) consider that it is possible to perform a modernized approach, such as: ``*The next boom of the international economy will be generated for, at least, the future 20 years by the companies using the technologies, expertise and approach from the nuclear and advanced light research and astronautics,,*. We have to admit that the research in astronautics started to come earlier to the commercial sector than similar advanced research from nuclear and laser research. The Large Scientific Infrastructure in the nuclear and laser field will develop their own **Knowledge Transfer Gate / Hub (KTG)** in Europe with the support of public radio and public television. Extreme Light Infrastructure -- Nuclear Physics started to think and to work on this with the Romanian Radio Broadcasting Corporation (National public radio). ELI-NP's management together with Magurele High Tech Cluster (MHTC), a business association of entities created around the laser project, advanced the idea of developing joint research and innovation projects with the commercial sector. This is the new trend from the years to come. The advanced research (ELI-NP) and the business sector have to apply for the European funds looking to their joint developments. Also, the commercial sector has to generate new products and services on the European and international markets as a result of the cohabitation with the scientific research.

4. Conclusion

If Europe will continue to identify itself as one of the economic leaders of the world, then the next industry of our continent will be advanced research. The new engines of the European economy, in our understanding, will be: nuclear research, extreme intensity light research and astronautics. These three areas of advanced research will generate dramatic positive changes in the day by day live of each of us. The new industry will develop a large range of activities and jobs which will modify the labor map. The relocation of large companies to Europe will be one of the concrete result of the stimulating the advanced research. If the percentage from the GDP will be higher for a decade or more such kind of relocation will be normal movement.

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