

## **APPROACHES TO INNOVATION: The need for consistency.**

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The term “innovation” is core to modern science and society with respect to novelty, creation and added value, yet it is also a source of misunderstandings. We aim herein at the clarification of the different approaches to innovation by establishing three general types: background, basic and applied innovations. The relation between the three concepts is also established. The exclusive relationship between innovation and market is put into question. The contradictory conceptions of innovation are also accompanied by complementary connotations that can enrich one to other. Finally, a transversal proposal to deal with “innovation” in different environments is introduced.

### **1. CONTEXTUALIZATION**

“Innovation” is widely used in many social-economic areas, unfortunately rather often with a nebulous and not clear content.(1) Innovations is mostly associated to positive added values to qualify knowledge, objects and processes. It is a word well-accepted by society but with different conceptions that are clearly reflected in the similar and different definitions in a great variety of Dictionaries and papers, offering more than fifty different definitions.(2,3)

Contradictive approaches to innovation can be found as for the well-known sequence R+ D + I. Innovation (I) here can lead to the idea that research is out of innovation.

Innovation is not an exclusive word applied to Science and Technology realms. Its meaning is quite general and applied to a variety of fields such as: Education (teaching-learning innovation), Economy (business innovations), Industry (production innovations), Agriculture (irrigation innovations), Pharmacy (drug delivery innovations), and so forth. It is obvious that there are several meanings of innovation.

We aim at stating the correct understanding and use of the term “innovation”. Innovation should be interpreted from a more diverse perspective than the traditional innovation-technological production link, see Figure 1. According to Barrabés, “now is the right time for breaking the exclusive link between innovation and technological production/market” (4)

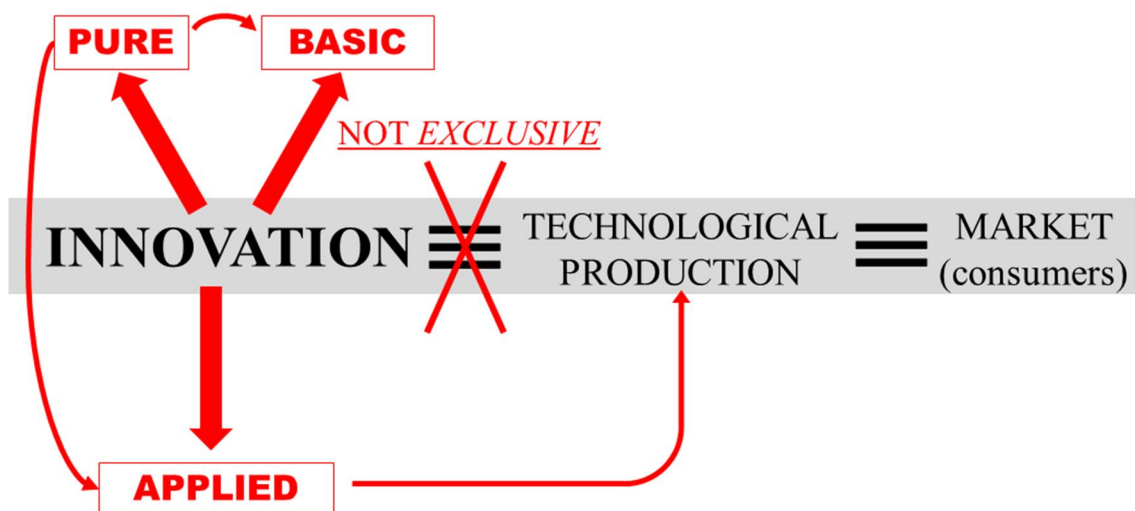


Figure 1. The new approach to innovation breaking the traditional (horizontal, grey) link between it and technology-market and showing other interrelated meanings of innovation. This scheme summarizes the content of this paper.

## 2. THE 1+2 MAIN MEANINGS OF INNOVATION

The background or pure concept of innovation can be split into two relevant concepts, being both ascribed to the classical fundamental and applied facets of the majority of scientific areas, respectively. In Figure 2 the basic and applied concepts of innovation are depicted, along with their internal relationship is clearly reflected. Both are under the background innovation concept. Note that individual innovation is mostly attributed to the basic innovation whereas organizational innovation is related to the applied conception.

- 2.1. Background innovation (from the Latin word "in-novatio"), that means creating something new, e. g., paradigm, procedure, device, tool, strategy. Many reputed Dictionaries compile in different ways this concept: the creation of something new that deviates from established doctrine or practice, something newly introduced or that differs from existing forms. This background concept is materialized in two general acceptations of it that are commented on below (2.2 and 2.3).
- 2.2. Basic innovation, which corresponds to the generation of a new idea, invention, paradigm or device. In this case, the novelty is created from any precedent model or from an already existing system, with the innovation lying in the change and improvement of the previous model. This is the case of the revolutionary contributions, with Leonardo da Vinci and Einstein as foremost examples. This type of innovation can be directly related to the verbs to create or to invent. An invention is a creation, a design and lately production of something truly new.
- 2.3. Applied innovation is the most used concept of innovation and widely used in research, programs, companies, organizations. It is close to the general concept that exists in both social and economic realms and the

last step (I) of the classical sequence R + D + I. A relevant aspect of this acceptance is this unequivocal relationship with the words “production”, “market” and “consumer”, which can be considered the main difference from basic innovation. Applied innovation can also be defined as: A) A novelty introduced in the market which adds value to the existing; B) A creation or modification of a product/system and its introduction into the market; C) The process of translating an idea or invention into a good or service that creates value or for which customers will pay as defined in the Business Dictionary.

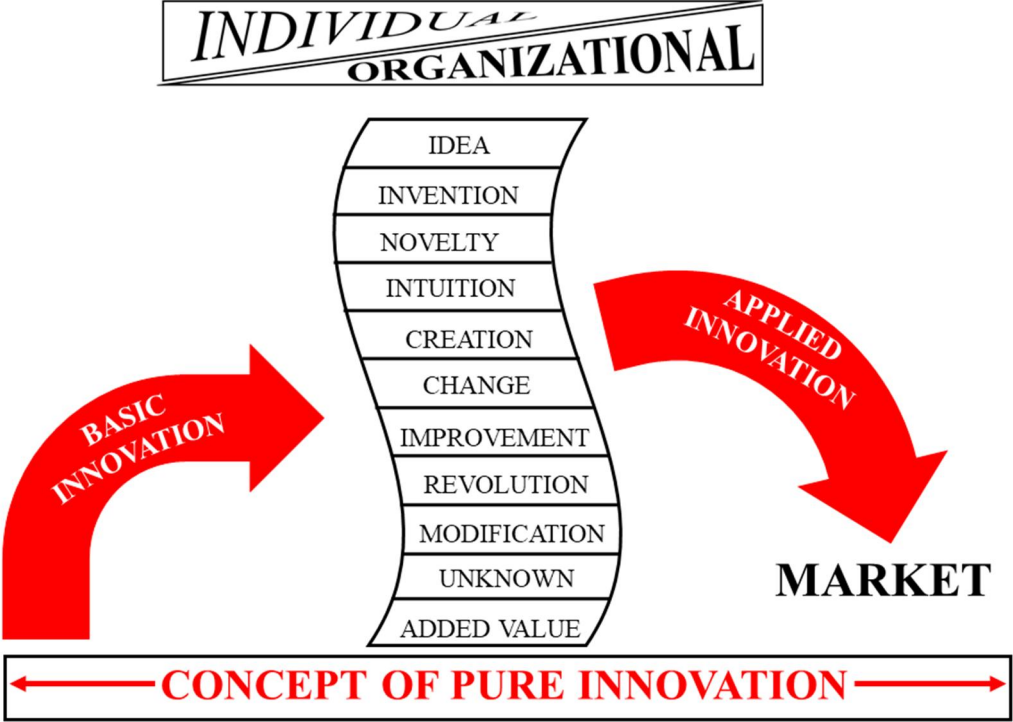


Figure 2. The background concept of innovation.

### 3. BASIC INNOVATION

This type of innovation is close to the pure concept (see 2.1), yet being different. Basic innovation is described according to the following complementary aspects:

- 3.1. Definition. Basic innovation is a creation arising from no precedent and materialized in a new idea, paradigm or device. Basic innovation is usually performed by single individuals, driven by permanent questioning and constant curiosity. This type of innovation can only be implemented by privilege minds. Basic innovation requires an appropriate environment, e. g., Florence at the end of the 15<sup>th</sup> century for Leonardo da Vinci.(5) A permanent search for establishing bridges with different areas of knowledge is fundamental here.
- 3.2. Net added value to knowledge. Results of basic innovation should be significantly different from those already established. False innovation is, unfortunately, quite frequent in the present scientific and technical literature. Small variations of pre-established ideas, processes (i.e. incidence of mammalian cancer in a region of Illinois (USA), repetition of a well described electrochemical paper by changing 0,1 pH units) cannot be considered true innovation. The great pressure to publish that today's suffers scientists or research groups/centers due to a wrong science evaluation is the main reason of the promotion of false innovation.(6)
- 3.3. Curiosity, imagination, creativity, ingenuity. Personal features such as curiosity, imagination and ingenious, but also with an appropriate crucible to melt they promote the basic innovation approach.
- 3.4. Synergy. Great inventors always look for breaking the classical barriers of the scientific and technical areas. The Einstein's violin and the Leonardo's paintings are representative examples of the importance to have a global vision of the world to be a revolutionary innovator. Basic innovators establish fruitful interfaces such as Art-Sciences and Humanities-Technology, in such a way that they can be considered a characteristic of true innovators.

- 3.5. Risk of failure. Basic innovation implies a close-to-zero starting point, therefore confronting with a high or moderate possibility of non-success. Note that false or irrelevant innovation has a minimal risk of failure; the so named “incremental research” is characterized by small variations of already published. The Research Assessment Agencies should change the evaluation criteria, mainly based on numbers (number of papers, impact factor, Hirsch index, and so on), to support true innovation by establishing complementary qualitative criteria, such as precedents, risk of failure, potential added value, auspicious environment, etc. These Agencies are essential to promote basic innovation in research because their decisions orientate the potential applicants to call of project proposals or individual promotions. Innovation is the only way to reach the frontiers of knowledge and technology.
- 3.6. Research & innovation relationships have been described for more than 50 years, with plenty of available literature. Three non-exclusive relations might be defined: i) Basic innovation can decisively help research to be competitive and reach high quality: *innovation in research*(7); ii) Specific research can be devoted to promote and to improve applied innovative processes: *research on innovation*(8); and iii) *Research is directly linked with innovation* means that research takes place before innovation that is the conception of European Union (9) and OECD.(3)

#### **4. APPLIED INNOVATION**

The great challenge of applied innovation is the establishment of a clear cut differentiation between innovation and evolution, that is, the introduction in the market of a true novelty or a simple extension of that previously described and used.

It should be recognized that applied innovation is frequently named simply as innovation by politicians and science administrators to define the transference of

the results of research and development in the classical sequence R + D + I. This is a wrong approach because the letter I must be substituted by T (Transference of knowledge and technology to the market). Thus, the correct sequence should be R + D + T. Nevertheless, OECD establish that “innovation goes far beyond R + D”.(3) Such usages of the term “innovation” are directed at marketing purposes, leading to misunderstanding and confusion in the actual meaning of innovation.

Some authors establish a difference between invention and innovation. “An invention becomes useful to others that it becomes an innovation”. Thus, invention is basic innovation and innovation is the applied facet of it which is a great error. It is important to circumvent the confusion between “applied research” and “applied innovation”. Not all the results of applied investigation reach their implementation (transference) to products/systems to be used by costumers.

4.2 Classifications. According to the Oslo Manual(3), there are four types of applied innovation, namely: Product innovation (good or service that is new or significantly improved), Process innovation (A new or significantly improved production or delivery method) Marketing innovation (A new marketing system involving significant changes in product design, placement or pricing) Organizational innovation (A new system of management in business practices)-

## **FINAL REMARKS**

The existence of different conceptions of innovation in different environments is undeniable. The challenge is to connect the apparently isolated concepts. This integrative approach should be disseminated to Science, Industry and Society, Enterprises, therefore avoiding misunderstandings. We propose here to use background or pure, basic and applied innovation that can be considered the “links” between the isolated compartments of innovation.

The misuse of this attractive word has led to confusion in many occasions. Such is the case of the sequence Research+Development+Innovation, in which innovation is of the applied type and equivalent to the transfer of knowledge and technology. This misconception might break the connection of innovation being applied to research, which is a great error. The title of the Horizon 2020 program

is “Research and innovation in the UE” which is representative of the philosophy of the Commission.(9) Remarkably, the sequence R+D+I is circumvented in the glossary of terms of this program because the applied meaning of innovation is exclusively used. It is far from basic innovation directly applied to Research, Science, Technology, etc.

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