
Innovation: What Exactly Are We Talking About?

Contrary to what we tend to think, innovation is neither a fashionable preoccupation nor an embodiment of capitalism. The history of techniques makes us understand that innovation is an integral part of humanity [JAC 11]. The philosopher M. Puech confirms this viewpoint. According to him, technique has been by man's side right from the origin of humankind, it has been at the core of humanization, whereas science has only been by our side since relatively recently. This joint evolution of homo sapiens with technique even makes him allude to the term homo sapiens technologicus [PUE 06]. However, the issue of what precisely the concept of innovation covers arises. We will demonstrate that it is the ability of innovation to create value that allows us to distinguish it from invention. This value creation can be seen in innovations which take on various forms and have an impact which is also varied in nature.

1.1. Some key distinctions

1.1.1. *Distinguishing innovation from discovery and invention*

The third edition of the Oslo Manual [OEC 05] defines innovation as the implementation of a product (a good or a service) or a new or distinctly enhanced process, a new marketing method or a new organizational method in corporate practices, the organization of the workplace or external relations.

From this point of view, innovation is defined according to the novelty criterion and the Oslo Manual specifies that it could refer to a novelty for the company, a novelty for the market or a novelty for the whole world if the concerned firm is the first to launch it in all the markets and in all business sectors.

As the novelty criterion also applies to the concepts of discovery and invention, we feel that it is important to demarcate innovation from discovery and invention.

Discovery is the act of finding something that is hidden. Such as the discovery of the double helix structure of DNA by J. Watson and F. Crick in 1953 for which they were awarded the Nobel Prize for medicine in 1962. Also, the discovery of the giant magnetoresistance principle by the physicists A. Fert and P. Gruenberg in 1988 for which they received the Nobel Prize for physics in 2007. Thus, and as pointed out by the philosopher of science M. Serres¹, only things which were already in existence but remained unknown, things which had not yet been seen, can be discovered. For example, the development of a technique to manufacture microscope lenses of a quality and power unknown until then elsewhere in the scientific world at that

¹ Interview can be accessed online: <http://fresques.ina.fr/jalons/fiche-media/InaEdu04626/la-decouverte-scientifique-selon-michel-serres.html>

time is what led to A. van Leeuwenhoek's announcement of his discovery of the human sperm at the Royal Society of London in 1678. More recently, the HARPS spectrograph installed on a telescope of the ESO (European Southern Observatory) in Chile and measurements carried out between 2000 and 2014 on ESO's telescopes made it possible to discover that Proxima Centauri, the nearest star to the Sun, had a planet². Published, in August 2016, in *Nature*, these research works show that this exoplanet, baptized Proxima b, is rocky and has a mass that is comparable to Earth's mass.

Discoveries can materialize through inventions. There are numerous examples of "discovery followed by invention" pairs. By way of example, we can cite electromagnetism and electricity networks, thermodynamics and spark-ignition engines. Contrary to discovery, invention and innovation are artificial. They make a hitherto unseen reality happen. Considered as such, discovery comes within the scope of research, whereas invention and innovation come within the scope of engineering. Discovery belongs to the past, whereas invention and innovation belong to the future.

1.1.2. What is the distinction between invention and innovation founded upon?

With invention, we move away from the realm of natural and formal sciences and draw closer to the technical domain so much so that invention is often mistaken for innovation.

In fact, in both cases, we end up with an outcome that seems like something new and the structure of their creation process is identical (each one has a cost associated with it, implying allocation of specific means, each one needs time to emerge, proceeding by trial and error, going back and forth,

² The relation between scientific discovery and development of technical objects may be noted.

etc.). However, it is necessary to distinguish invention and innovation, because not every invention systematically translates into an innovation³.

At this juncture, we can cite the example of the invention of the digester by D. Papin in 1679. D. Papin's digester is a kind of cooking pot in which water changes to steam, and then pressure and temperature build up until they attain the level of pressure fixed by the safety valve. Fitted on the cover, the steam-release valve keeps the digester from exploding.

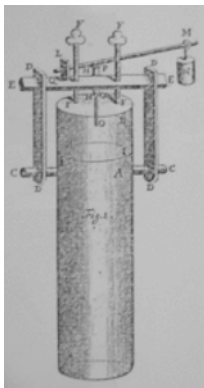


Figure 1.1. *Papin's digester* (source: http://fr.wikipedia.org/wiki/Denis_Papin)

In his book titled “*La manière d’amolir les os et de faire cuire toutes sortes de viandes en peu de temps et à fort peu de frais*”, after describing the digester, D. Papin recounts his discoveries and experiments on cooking, in particular of meats, fish, vegetables, etc. And because people object, he says, to new inventions claiming that the expenses incurred will be greater than the profits they could generate, he devotes his ninth chapter to “Price calculation” and demonstrates the profitability of such a machine. But less inclined to trade, he did not make a commercial application

³ We will discuss this point at greater length in the course of Chapter 2.

of his invention. It was in 1953 that SEB innovated from D. Papin's concept and launched the SEB Super-Cocotte (pressure cooker).

Over the past few decades, other French and foreign companies have produced pressure cookers based on the same principle of cooking through an increase of pressure and temperature. The advantages of this very first French pressure cooker, manufactured by the stamping process, are to be found in its robustness and lightness, its aluminum body which is a good conductor of heat, the fact that it is easy to clean and its price, which is two times lower than the average market price.

Value creation is all the more apparent when we see that the Super-Cocotte perfectly met requirements at the time. Barely three years after the end of ration cards, households were keen to give proper nourishment to their families within a tight budget. Although beef was the main component of daily food at that time, it had the disadvantage of requiring cooking over a long period of time, especially for the least expensive pieces. In other words, the money saved by buying cheaper cuts of meat was spent on gas to cook it. This economic sales pitch was therefore widely projected at the time of its launch.



Figure 1.2. *Super-cocotte SEB, 1953* (source: <http://www.seb.fr/marque/historique.html>)

The preceding example allows us to note that the main characteristic of innovation is to meet a requirement that can be stated or latent. The notion of need is important to the extent that it underscores the point that innovation does not necessarily respond to an explicit demand from a consumer, but can sometimes be forced on him/her, which explains the idea of a latent need. By doing this, we move away from the definition set out in the report of the *Office Parlementaire d’Evaluation des Choix Scientifiques et Techniques* (The Parliamentary Office for Scientific and Technological Assessment) entitled *Innovation Facing Fears and Risks*, according to which “*Innovation is the art of integrating the best state of knowledge at a given point in time in a product or service in order to meet a need expressed by citizens or by society*” [BIR 12, p. 15]⁴. We align ourselves with J. Schumpeter, who already emphasized in *Business Cycles* that innovation does not necessarily come in response to an expressed need:

“Railroads have not emerged because any consumers took the initiative in displaying an effective demand for their service in preference to the services of mail coaches. Nor did the consumers display any such initiative wish to have electric lamps or rayon stockings, or to travel by motorcar or airplane, or to listen to radios, or to chew gum.” [SCH 39, pp. 67–68].

Concretely speaking, the idea of need refers to the ability of innovation to create consumer value. What does this mean exactly? Consumer value is assessed in relation to the perceived benefits (promise of an innovative offer) by

4 As we will see further ahead, disruptive innovations, or innovations with regard to the identity of products, do not necessarily originate from a demand.

the said innovation⁵. However, the consumer value is “reduced” by:

- the perceived cost of innovation, which includes the purchase and maintenance costs related to the acquisition of the said innovation, and also the time and effort required to appropriate the said innovation. Is this innovation easy to use or does it require a training period? For instance, changing one’s smartphone is likely to entail certain costs to become familiar with a new interface;

- the risks that the user associates with the use of the innovation. Microwaves, just like cell phones, are the subject of major controversies even today with regard to their health hazards. In January 2010, the production of *Google Glass* was suspended, owing to its sale price (1,499 dollars) and also due to the hostility of people who were uncomfortable with the idea of being filmed without their knowledge. Similarly, users are bound to ponder over interoperability hazards.

An invention whose value creation has not been demonstrated will thus never reach the innovation stage. This explains quite precisely the fact that very few inventions presented at the Lépine competition get into the public domain.

We must, however, point out that value is a subjective notion. What might seem “useful” to a person might not necessarily be so for others. Let us take the example of skis. A mother would prefer a ski that comes off easily in case of a fall for the sake of her children’s safety and in order to avoid risks of a fracture. On the contrary, an extreme skiing enthusiast would much rather go for a tight fit which would come off less easily. Likewise, although today we find cell phones whose prices range from 10 euros to more than 700,

⁵ We must specify that value creation for the user should not disregard the issue of economic viability necessary for the deployment of the said innovation. We will discuss this point subsequently.

it is quite simply because we don't all give the same importance to having a multi-functional phone, to video quality, to the speed offered, etc.

Moreover, value is a social construct as we can see in the case of toilets. Because the way we equate cleanliness is not the same in each country, we do not purchase the same WCs. In countries where toilet paper is not used (because it is believed that paper does not clean thoroughly), people wash with their hand. In these countries, adding small taps located below the toilet contributes to creating value. Similarly, in Japan, we find features in toilets which are likely to be considered rather pointless in other countries: a heated seat, an air dryer, adjustment of the position of the water nozzles, etc.

We would like to lastly specify that value creation implies that the designed object is not only useful but also usable. This is the reason why chindogus, unusual or weird tools, cannot be considered as innovations.

1.2. Typology of innovations based on their purpose

Value creation can take place both small enterprises and leading multinational companies. It is not restricted to certain business sectors. We can innovate in the automobile industry, the habitat segment, the food-processing industry as well in case of products that are as unremarkable as toilet paper.

On the contrary, innovation is protean in nature. In fact, innovation can relate to:

- Products (such as the Bluegard® autonomy bracelet; endowed with a geolocation system and a 24/7 monitoring system, connected to a platform; devised for Alzheimer's patients), or a service feature, such as home help for the elderly.

– Processes such as hydroponic agriculture without soil (wherein soil is replaced by a sterile substrate, such as clay pebble substrates or rock wool substrates) or second generation biofuel production from agricultural residues.

– Marketing. In this case, it can be based on a new distribution method. For example, to go with the consumer's wish to opt for local and neighborhood channels, to get back to direct purchase from the producer; it is also egged on by the craze for bulk offers which makes it possible for Auchan to throw open its doors to 13 million single persons and 2.5 million students in France who happen to be consumers with moderate requirements and therefore do not want to be forced any longer to buy quantities imposed on them and who thus finally discover the feeling of having control over what they consume [DEL 15]. Marketing innovation can also be based on a new pricing principle (low-cost-based strategy) or on a new packaging policy (Pom'Potes compotes from Materne in their flask format meet the consumers' current trend to be on-the-go and the need to have easy-to-carry balanced children's snacks).

– Organizational. As an illustration, we can quote the 80/20 principle initiated in the 1930s by W. McKnight, the then CEO of 3M, which aimed at allowing employees who wished to do so to devote 20% of their time (i.e. 1 day per week) to working on projects of their choice. This approach, which gave birth to post-it in 1974, has now been adopted by Google through their famous 70-20-10 law.

– Social, i.e. innovations which “simultaneously meet social needs and create new social relations or new collaborations” [MUR 10]. For illustrative purposes, it is fair trade that contributes to creating the conditions of international solidarity between the North and the South. Yet, another thought that comes up at this juncture relates to micro credit initiated in the 1970s in Bangladesh by Professor M. Yunus, winner of the 2006 Nobel Peace Prize,

who wished to enable the poor women of his country to indulge in modest economic activities.

Considering innovation from the forms it can take allows us to escape the confines of a restrictive definition of innovation with reference to the existence of a market. As emphasized by T. Ménissier:

“social innovation could be initiated by citizens, and emerge in the social space of political demands; this is clearly testified by the great social innovations of the 19th century favorable to solidarity: graduated tax, right-to-work, social security” [MÉN 11, pp. 12–13].

The consideration of the protean nature of innovation also validates the idea according to which the thing that denotes the innovative character or otherwise of an artifact does not lie in its technicality but in its ability to create value for its intended user.

1.3. Typology of innovations based on their scale

Even though all innovations have the characteristic of creating value for their intended end user in common, not all innovations have the same impact on society.

In fact, most innovations are incremental in nature. The main characteristics of this type of innovation are their frequency and autonomy, which implies that they do not make any in-depth changes to the existing established firms, no more than the product's production and marketing mechanism. The shift from glass Coca-Cola bottles to Coca-Cola cans does not entail any change in the industrial structure. Likewise, in the telecommunications sector, the move from 2G to 3G and subsequently 4G which improves the scope of digital data transmission would come under the

realm of incremental innovation. This type of innovation seems relatively easy to implement and control, the inherent level of risk is generally limited with regard to technical and marketing plans, and its financial impact is also less significant.

On the contrary, radical or disruptive innovation, though rare in occurrence, has major consequences on the entire production and marketing system and is a cause for considerable difficulties for established firms. At this juncture, we can, by way of illustration, cite the example of Kodak not wanting to go digital, which was threatening its film-based business model, and the subsequent fall of its market share of the French film photography market from 76% to 6% between 2001 and 2005; Kodak failed in making the right strategic choices. This strategic failure was the direct cause of Kodak's decades-long decline which led to its bankruptcy in 2012. Another example that comes to mind is that of the French Internet access provider industry following the launch of Triple Play (Internet, telephone and television) by *Free* in 2003 which enabled Free to become the second largest French operator in 2005. By modifying the reference offer, Free forced its competitors to reposition themselves and undertake mergers; this sounded the death knell for established providers (Alice).

To assert that innovation started off being radical and that the contemporary era would appear to be marked by the stamp of incremental innovations as J-P. Boutinet [BOU 12] suggests is misleading⁶. In reality, these two types of innovations have always coexisted and correspond to

6 It may be noted that C. Christensen prefers to speak of sustaining innovation and disruptive innovation. The former is done in conformity with the company's business model, irrespective of whether it is radical or otherwise. The latter is done in disruption of the company's business model, once again irrespective of whether it is radical or otherwise.

differentiated innovation strategies. Let us take the example of Saint-Gobain, the global leader in the housing sector. Saint-Gobain is a group backed by 350 years of history. It all began with the creation of the Royal Mirror-Glass Factory in Paris in 1665. During the past 350 years, Saint-Gobain continued to constantly innovate in its processes and its products. However, there is one thing that can be clearly observed: Saint-Gobain's innovation policy is not focused on disruptive innovation, insofar as its corporate culture is concerned, as this is too risky. According to D. Roux, a member of the academy of science in France and the group's vice president of R&D and innovation, this is what precisely differentiates Saint-Gobain and Corning. This also explains the fact that for several years now, the Research & Development department and the Marketing department have been working together at all levels at Saint-Gobain. This kind of organization enables it to better fine-tune its response to market expectations, anticipate future needs and, while doing so, shorten development time.

We must, however, point out that it is true that since the present era is marked by a race against time and rising competition, we tend to craft innovations in a hurry and favor incremental innovations. We have shown, for instance, how "emergency urban planning" makes us opt for widely accepted principles of solution without taking the time to question the models on which they are based⁷. As pointed out by E. Phelps, such a situation would not be as serious had the dictatorship of short-term imperatives not translated into a search for short-term improvements that generate less and less income and create fewer and fewer jobs in Western economies.

⁷ For this very fact, emergency urban planning is not really favorable to the broadening of the scope of opportunities. By bowing to these exigencies, it comes under the realm of reproduction rather than that of innovation.

1.4. Reasons for innovation

The genesis of innovations arises from various motives:

– Innovation is a means of adaptation to the changes in the environment. If we think of the competitive, technological, institutional environment, etc., it can never be permanent as it evolves constantly. These evolutions act as real incentives to innovate. We can cite the example of the removal of import quotas for Chinese textiles which came into force on January 1, 2005 in Europe. This move gave rise to more than a 50% hike in certain textile product categories. The removal of these quotas forced a number of French and European companies to reposition themselves on strong value-added products (such as smart textiles). We can also cite the issue of scarcity of certain raw materials. The coal carbonization system was, for instance, invented to solve the problems created by the scarcity of wood in England. Similarly, to manufacture soda ash, we used to import a plant called salicornia from Spain. The wars during the revolution followed by those during the Empire put a block to exchanges between France and Spain, but soda ash was indispensable for soap and glass manufacturers. It was then that the choice was made to use a process invented before the revolution, which made it possible to manufacture soda ash from sulfuric acid and sea salt.

– Innovation is also a means to adapt to the introduction of new standards. The 2002 decision of the Health Nutrition National Plan to reduce salt consumption by 20% over a period of 5 years in order to alleviate hypertension problems and cardiovascular hazards impelled the stakeholders of the food-processing industry to innovate. Similarly, the circulation of the sustainable development guidelines in the wake of the 1987 Brundtland report paved the way for the introduction of new standards. The latter are, for instance, at the root of:

- The development of new materials in construction (insulation using materials of plant origin: wood, cellulose, hemp, cotton, linen, etc.);

- The increasing use of natural fibers in the automobile industry (which replace synthetic or glass fibers);

- The increasing use of composites in the manufacturing of aircrafts. Airbus A380 is, for instance, the first commercial aircraft structure is made with 25% of composite materials. Out of these 25%, 22% of the structure is made with carbon, glass or quartz fiber composites and 3% with GLARE (an aluminum–glass fiber laminate, used for the first time in a civil airplane). As they are lighter than aluminum, composite materials decrease the aircraft's unladen weight. For instance, making the center-wing section with carbon increased the weight of the aircraft by one and a half tons. The decrease in weight ends up reducing fuel consumption and therefore leads to a decrease in operating costs and lowering of emissions released in the atmosphere;

- And even the fabrication of sustainable cities, especially after the Aalborg conference [FOR 15].

- Innovation provides a means for coping with the saturation of markets: a family of four owns around 3,000 objects, whereas it didn't have more than 200 objects 100 years ago! This situation has arisen due to the fact that goods which were earlier considered as luxury goods have now become everyday consumer goods (cars, TV, personal computers and smartphones), in particular owing to the fall in the sale prices of certain products because of productivity gains. The only way in which manufacturers who sell these types of products can regenerate demand is by innovating.

- Innovation finally appears as the means to meet major contemporary challenges such as the aging of the population, social justice, and the consideration of the guidelines for sustainable development to quote only a few.

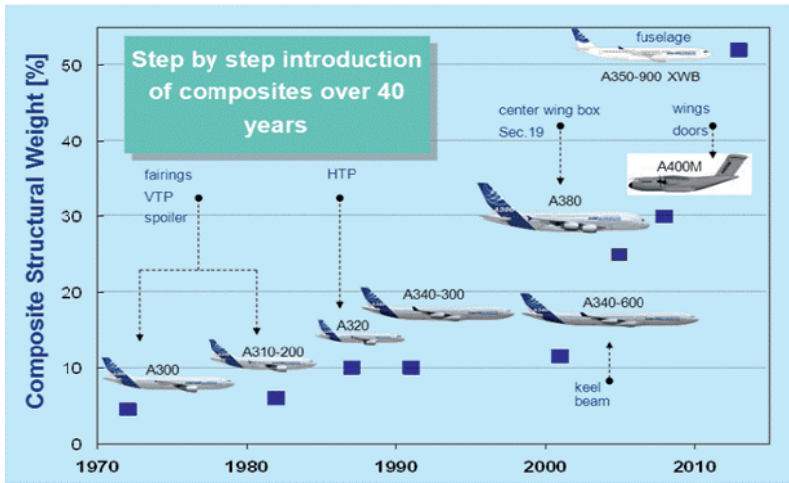


Figure 1.3. *Evolution of composites (source EADS, 2011)*

Now that the concept of innovation and the reasons for innovating have been specified, the issue of identifying possible means of action to innovate has to be addressed. In order to do this, let us examine beforehand the relationship between the innovation model and innovation management.

