

# **Semantic Innovation. Sustainable building, product innovation, market.**

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## **Abstract Title**

The paper shows that it is possible to distinguish between innovations that involve more the product from those that concern the process, and it can also be identified innovations that go to influence greatly the meaning of the product or process. This third type of innovation is called "semantic innovation" and may be recognised when the products or the processes are explained and illustrated in relation with the vast theme of sustainability. The paper proposes an interpretation of an innovation process based on dialogue with stakeholders, a process by which the building project and, more specifically, the project of construction products can satisfy the need for environmental compatibility and can position itself on the market in innovative ways. The paper shows examples and discusses the dynamics of innovation in the construction industry in relation to the increasingly clear demand for sustainability.

**Keywords: product process and meaning innovations, sustainability, environmental labels.**

## **1. Introduction**

It is possible to distinguish innovations that involve more the product from those that concern the process, and it is also possible to identify innovations that go to influence greatly the meaning of product or process. The present paper calls this third type of innovation "semantic innovation".

The semantic innovation may be recognised when the products or the processes are explained and illustrated in relation with the vast theme of sustainability. A semantic innovation of a product or of a production process is based on a new set of meanings that the product or the process offers.

For example: consider a product that is in an advantageous position in the market by virtue of a strong semantic value. This product may have functions and costs comparable to similar goods, but also meets a number of requirements of another type. The product does not "works better" but it has "more meaning" and, because this, it better meets the system of values associated with the sustainability. Two similar products with the same characteristics and the same environmental impacts can compete in the market by organising and improving communication of their characteristics.

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For a company the demonstration of the sustainability of products and production processes is through certification, this certification becomes a tool useful to dialogue with stakeholders.

## **2. Building sector**

### **2.1 Central rules**

Buildings have to define spaces for humans, these spaces must solve housing needs, and also employment, economic, social and cultural rights. A building is quality only if it meets these needs. Needs are described by requirements that are variable over time because the needs are the result of a continuous process of study, development and innovation.

Designers and architects have to survey stakeholders' requirements and to define parameters for the preparation of a project suitable for them: in this way it is possible to reduce the assumptions in the design phase and the bad representations of reality (that are the basis of the poor quality of the projects). For this reason the construction sector may be described as a market built on demand-pull dynamics.

### **2.2 About the demand of sustainability**

Today, the definition of "good architecture" is also linked to the environment that surrounds the building. The landscape and the environment have become the testing ground of the buildings: on the one hand, the building began to be conceived as a "holder" versatile and adaptable to future needs, on the other hand, the development of the relationship between the building and the environment becomes a system of techniques and technologies to the natural environment. Everything is designed and manufactured not only to the quality of the environment inside of the building, but also to the quality of the ecosystem (the environment outside of the building).

It isn't easy to recognise the need of sustainability of the built environment, a clear understanding of this question is still missing. This is caused primarily by the technical difficulty of governing human activities in relation to the ecosystem, which is not easy to consider and measure.

The construction sector, as well as any other human activity, is no longer included in a well-defined temporal and spatial context (e.g., a place and a time of construction, or life-cycle of buildings). Today we are aware that every building has repercussions in time and space away from everyday perception.

It is necessary to compare the time frame of modern society, which claims to achieve everything at once, with the ecological model, which expands the period of time between action and reaction: this aspect has a strong relevance in the definition of sustainability and expands the responsibilities of those who build to non-compromise of ability of future generations to meet their own needs, in line with the Brundtland report (1987).

### **3. Innovations and certifications**

#### **3.1 An analysis of the requirements**

“A demand curve of product or a supply curve of output are clearly perceived only if you can describe the mechanisms through which these curves are clearly perceived” (Nelson, 1972).

According to this discussion it is mandatory to pay attention not only to innovative and/or sustainable products, but also (and above all) it is necessary to study the processes that make explicit and innovative the question of sustainability of the products. These processes lead to the description of the offer of products through the certification of sustainability (which can be considered an innovation themselves).

Indicators, certification and assessment methods have been developed thanks to the work of experts and through dialogue with stakeholders. These tools are intended to define and guide the correct environmental policies, providing a measurement of the priorities and objectives. In addition these tools are continuously updated in order to ensure communication between the various stakeholders involved in the construction process.

Therefore this information may be considered as requirements of sustainability of construction products. So innovation may “translate” these requirements in sustainable performance. These sustainable performance may be already known, already intrinsic in traditional products, or even unrecognized or inadequately communicated to the actors in the building process. In all these cases it is possible to “make innovation”.

#### **3.2 An analysis of the supply**

“Once there were blue-collar workers: a rather nice way to label the workers of the great nineteenth-century American industrialisation, workers already enough labeled by the navy blue suits they wore. Only a century later, around the '30s, an opposed idea ticks: employees in suit, white shirt and tie, are called white-collar workers and they become a symbol of the emerging service industry. Evidently, the twenty-first century could not be outdone: ladies and gentlemen welcome to the era of green-collar workers” (Magrini, 2009).

The text of Magrini explains the transformation of the economic model in the last century and sets the goal of sustainability. It is possible to achieve this goal by combining science, technology and entrepreneurial skills in a truly creative.

The producers of materials and building components are aware of the type of market created by the demand for and supply sustainability certification. But the decisions of innovation and improvement of production and marketing of goods inevitably involve a degree of uncertainty. To overcome this uncertainty, it is useful to refer back to the words of Nelson (1972). It is possible to see that (today) producers are faced with a series of instantly recognisable signals that influence the market and outline a futuristic scenario in which the buildings tend to have an environmental impact equal to zero. The innovation of construction

products is strongly influenced by these models of expectations, so the innovation of construction products may reduce the risk of failure and speed up processing.

Companies must implement policies and choices aimed at defining sustainability as a key to the economy of the future and point out that the power of the certifications will depend on the capacity to create connections and relationships among the new products and processes and innovations that are already identifiable today as examples of excellence in the construction industry.

The offer of certified sustainable products in response to a list of requirements is an innovation. This innovation can generate many other innovations if the list of requirements of sustainability is explicit, is relatable with product certifications and is re-formulated at a time when demand changes. Transparency in the enunciation of the offer of sustainability performance can allow the growth of the economic benefits of each innovation of products, processes or certifications themselves. Every innovation in fact leads to further innovation to the extent that it provides a framework that allows you to design, plan and operate various complementary and connected technologies.

### **3.3 International standardisations**

The policy described by ISO standards (2004) is intended to improve the environmental performance of industries and to reduce the pollution caused by processes and building systems. The purpose of the policies is not the control of emissions, but it is the achievement of an objective quality for the environmental system.

This approach, and environmental issues related to it, are inserted progressively in the economic management of the company. It may happen gradually, according with the time in which consumers become more careful and demanding about sustainability. Consequently, the regulations may become more severe and complex, providing greater levels of sustainability.

As a consequence, companies need to have reliable tools for the management of the need for sustainability. These tools must be able to address the business and production that have environmental significance. This led to the development of voluntary standards: these tools have different origins and different specific objectives. The first experiences are related to the chemical (such as the pharmaceutical or on the production of paints and varnishes), subsequently, the use of these tools is extended to a wider range of products up to involve more and more companies also of products and components for the building industry.

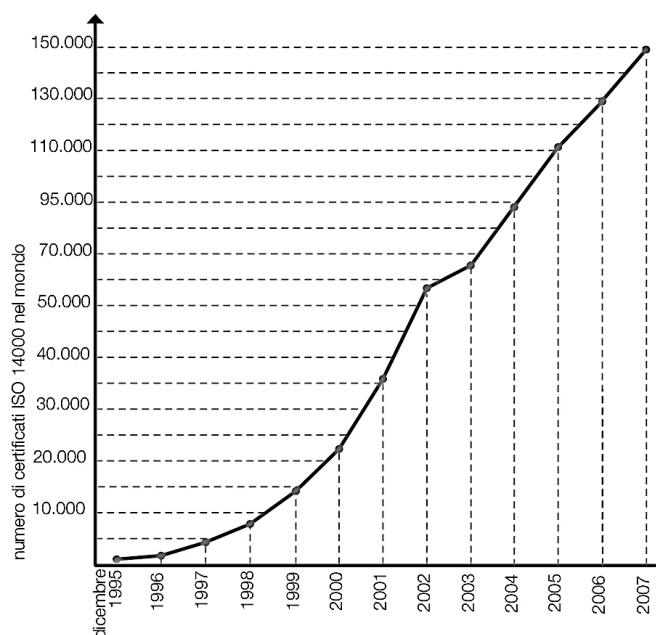
All types of standards have in common a fundamental characteristic: they contain general requirements and, above all, are voluntary. They do not represent an obligation but a tool for the company that want to improve the quality of sustainable production, guarantee it, and make it explicit to the judgment of consumers.

The proposer of a standard of sustainability of product (or process) may be the company itself through the associations involved in the production: in this way the first standards have

been developed. Standards have been designed precisely in order to use the certification of quality as a lever for the insertion of a product on the market or for the enlargement of a market of product. There are also standards developed by standardisation bodies such as the Italian UNI, the English BSI, the European CEN and the international ISO. Finally, a type of standard is issued by Public Institutions (in this category is the Rules Environmental Management and Audit Scheme, EMAS, developed in 1993 by the European Union).

Certifications and requirements of sustainability suggest innovations within companies; Professor Romano Dal Nord teaches that innovation is not the result of randomness, but is designed and planned. In addition, "the real problem that must be answered is how innovation is planned and why innovation is designed" (2011). In a very summary: the "how" is fulfilled by the tools made available by the certification bodies (e.g.: according to ISO standards) and the "why" is the need to respond to a series of requirements that are set out through the various forms of demand that construction market is now able to manifest (mostly in reference to the methods of assessment of the sustainability of the built environment).

Until now it is clear that sustainability is a widespread need and spans in all sectors of human activity. Consequently the first who will show to possess the capacity to fulfil requirements that define this need, easily will stand in a position of advantage over other competitors in the market.



**Figure 1: The graph shows the sharp increase in the number of sustainability certification (ISO data) [8].**

## **4. Semantic Innovation**

### **4.1 Communication**

A company can demonstrate the sustainability of products and processes in the first place, because of certifications, then thanks to the communication to all stakeholders. The dialogue between the parties is even more important, in fact, we must consider the interests of competitors and the uncertainty arising from the analysis of a highly complex environment in which the effects are not easy to determine.

It is important that all activities relating to the construction sector are based on information, this is a useful principle whether working to realise construction products, whether working to the construction of single-family residential units, whether carrying out large public projects. A bureaucratic processes and regulatory systems exist for each type of project, it is designed specifically to evaluate the quality and sustainability of each activity or each building. The quality of information (quality of content and quality of communication) largely determines the success of innovation, both product and process innovation. Moreover, the information can also be negative, if it is used or managed not in accordance with the parameters that guarantee its value, the bad communicated innovation fuels ambiguity and conflicts.

Technological innovation (of process and/or product) is at the base of the definition of companies strategies. Companies can pursue technological innovations in order to compete with other companies and provide users with the best products. The certifications are the tool which helps companies to compete with other firms and to dialogue with stakeholders.

Environmental certifications are tools to get an easy dialogue with all stakeholders in the building process and tools to improve products and processes. In this way the ISO and the “non-standard” environmental communications have become more and more important: these communications are voluntary instruments that have shapes, types and different content depending of many factors, which characterise every single company that wants to divulge their environmental policies.

Only the most recent environmental regulations have introduced EU standard to guide environmental communication and establish the importance of information, thus providing a new possibility for the development of innovation-communication dynamic that are at the base of a culture and an economy which take account of sustainability.

### **4.2 Definition**

"Innovation can refer to a product or a process: in the first case the result of innovation regards material objects, and the second the immaterial ones (i.e. the mode of certain operations and the organisational and procedural aspects). Sometimes some innovations occur only at the level of the product, sometimes the existence of a new product also involves transformations more or less deep in the process in which the new product is inserted, sometimes even these two types of innovations can be so closely connected

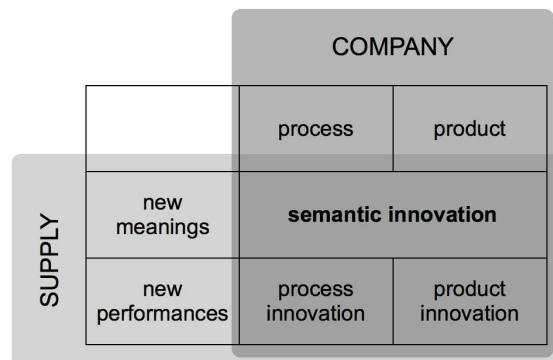
between them, so that it may happen that an innovative product should require a transformation of the processes useful to realise and/or to use it and that these (in turn) act on the characteristics of the products, that, at the end of the cycle, may submit additional characteristics of news” (Sinopoli, 2009).

Nicola Sinopoli (2009) clearly describes aspects of the innovation in a number of different levels. In this way a definition of product innovation and process innovation is given: but, taking into account the sustainability, this may have a slightly different meaning.

First, the theme of sustainability crosses the board to knowledge and human activity, sustainability causes both product and process innovations. E.g. the additional informations provided about the products get the product to meet the demand of sustainability and describe both the product and the process.

This type of information is governed by ISO and, due to its complexity and the importance, it can be defined “semantic innovation” (Barucco, 2011). If it is possible to distinguish innovations that involve more the product than those that involve more the process, it is also possible to identify innovations that affect more the meaning that the product and the process reach when they are explained and illustrated in function of the sustainability.

When a product is in an advantageous position on the market by virtue of a strong semantic value it can have functions and costs comparable to similar goods, but it also meets a number of other requirements. The product does not “works better” but it has “more sense”, it meets the system of values associated with the sustainability socio-cultural model.



**Figure 2: Scheme of the "types" of innovation identified in reply to the new demands of the market (supply) and to the variation of innovation within the company.**

## 5. The characteristic of semantic innovation

### 5.1 The ways of the innovation

Innovation gives positive results in the company's balance sheet if there is a certain advantage in the market: this is the result of the comparison of each company with competitors. The semantic innovation can change both the process and the product that a

company offers, and it also can change the value of supply according to the requirements of sustainability. We must remember, however, that it is not possible a clear distinction between the different forms of innovation (process, product, meaning) but the description proceeds according to this simplification for clarity (fig. 2).

The transformation of the production process and the organisational process of a company is the result of the increase of knowledge. If this transformation is the result of a temporal evolution estate and a subsequent reconstruction of know how, this transformation is defined “revolutionary” and generates a discontinuous innovation. This transformation may be the result of a stop of innovation and a subsequent recovery aimed at ensuring the survival of the company. This path is rarely carried by a choice of the company, but more often it is induced by an unfavourable market environment. The discontinuous innovation can also be the result of research and development (R&D): companies that invest in this strategy know that, for the period of time spent on research, they will not achieve the product or process, and the practical outcomes of the research will come only later in the development phase. In the case of semantic innovation, the research will formulate theories that the development will make applicative to the business case to get a new way to communicate the sustainable performance of the products. Further on in the paper, in comparison with other types of innovation, these dynamics will be better explained.

Opposite of discontinuous innovation, incremental innovation of the meaning of products is when the company is able to communicate over time, a series of improvements of both the product and the process. This type of innovation occurs through a continuous dialogue with stakeholders: in this way the solutions are changed, adapted and improved in a continuous manner. This model is applied frequently in those areas where the renewal is rapid, such as computers, which are placed on the market and then updated and/or changed in response to what is being communicated by users.

Nicola Sinopoli said that the construction sector is instead characterised by a “suspicious and essentially conservative” approach to innovation, he also said that “products used today usually have often spent decades to establish itself significantly in our country” and that the products are successful “if they respond effectively to a need that mix not only the needs of the retail market, but also those of all intermediate markets” (2002). In a sustainable approach the intermediate markets are those that belong to the chain that characterises the product during its entire cycle of life, from raw material extraction to disposal and recycling.

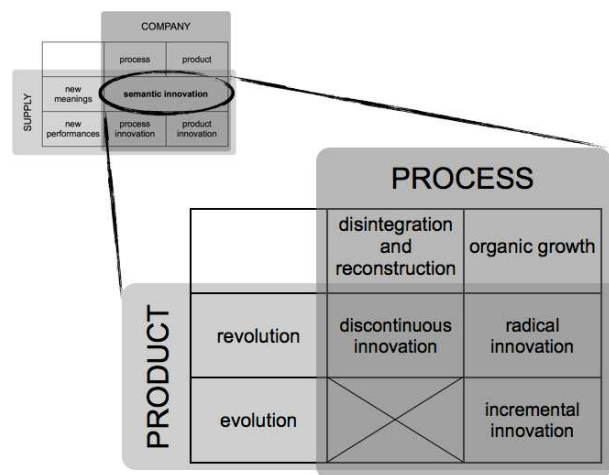
As previously mentioned, widespread attention for the sustainability facilitates product innovation. In the case of incremental innovation, it is possible to notice that frequently it is available a precise documentation that traces the history of each product: in this way the supply chain is easy to recognise and each stage of the supply chain has interest to declare its own characteristics of sustainability. Semantic innovation of each phase of the life cycle of the product affects each subsequent phase, that affects each customer, ensuring the realisation of a final product that meet the demand for traceability and the description in terms of sustainability.



The demand of sustainability is answered getting more transparent each step of the chain of transformation of products and processes: if the answers are provided in a timely manner, the company makes incremental innovation and remains on the market with constant relative advantage compared to other companies competitors who, in turn, make incremental innovation to meet the changing needs.

The discontinuous innovation can bring benefits but presents risks and needs the support of an organisation such as R&D. Incremental innovation does not involve high risks and costs, but leaves little advantage over competitors. Instead radical innovation takes the advantages of the two types described above.

In the case of a radical innovation built on the new meaning of a sustainable product or process, the gradual transformation of the process is done through the organic growth of skills and knowledge, considering both the “hard” aspect of production, and the “soft” aspect of the management and organisation of the company: this technological development, if guided by a correct view of semantic innovation, can help to deliver revolutionary increases in product performance (fig. 3).



**Figure 3: diagram describes how the semantic innovation is related to the timing and the method of transformation of processes and products within the company. Figure 3 refers to Figure 2 for the identification of activities to be developed for the innovation of the product and of the process [12].**

## 5.2 The waves of the innovation

To build an adequate vision of innovation, or of an innovative scenario, two focus are necessary: the comprehension of user needs and the translation of those needs into applications that are designed to satisfy them (note that this is the definition of “requirement”).

The future scenario (or, rather, the reference scenario) of innovation must be the result of reflection on what will lead the advancement of research and technology in a background that is marked by economic and financial crisis, by the energy crisis and by the imbalance environmental.

What will be the framework for the promotion of the building products? What are the characteristics that determine the value of these products? It is also appropriate to argue about the way to start today to produce and use sustainable products by virtue of the logic of market advantage, before the criticality of the situation becomes such that the change will be imposed. These considerations, if inserted into future scenarios regarding the exploitation of energy and environment resources, show possible evolution of building practices.

In the past human activities were aimed at defining a sort of dominion over the earth. We are now aware of the weakness of our knowledge, and that this is linked to the characteristics of the society in which we live, to the spread needs and to the relationship with the natural environmental. This critical theory is a necessary condition for the growth of knowledge, for the awareness of the unpredictability of what awaits us, and for the desire for freedom. A freedom that is not only a value for the present, but also for the future, a future in which the choices and goals may be different from those of today.

This process is described by prof. Longhi through the recognition of "three waves" of sustainability, Longhi describes the transition from a conception of unlimited trust in technology (typical in the age of Enlightenment) to a critical approach on the bases of knowledge (2003).

The first wave of sustainability can be titled "between the limits of development and limits of poverty", it is characterised by the debate between the "rhetoric of the value of the environment" (Meadows, 1972), and "rhetoric of the value of man" (Bariloche, 1974). This contrast can be explained by an example given by Buckminster Fuller (1969). He describes the history of man as the growth of a chick inside an egg: nature gives the bird, as human beings, protection and nourishment until it becomes large enough to break the shell and find out for yourself a living. According to Fuller we are at the moment when the man breaks the egg, but do not forget that there is not a different natural world in and out of the egg in which humanity grows.

The cultural change that occurs in the transition from the first wave to the second is all in understanding this example. The second wave is characterised by a shift "from rhetoric to action" (this is the title of the second wave). Since 1997 many theoretical debates take place and a series of events and occasions are organised at the aim to study policies and practical strategies for the management of natural resources and the estimation of the influence of human activities on the ecosystem.

The third wave of sustainability is now in place (or, rather, should be in place). The third wave defines "new rules for the project" of human activities. To recap: the first wave explained that there is a limit beyond which the overall balance is no longer guaranteed, the second wave has provided tools and strategies for assessing the sustainability of human

activities, the third wave, finally, is responsible for innovation that will allow future generations to enjoy the freedom for which humanity has enjoyed to date. This innovation should enable the technologies, processes and heritage building and infrastructure existing in industrialised countries can be changed. Thus human activities will relocate under the limit that ensures a global balance.

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