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Interactional innovation: a neo-Schumpeterian model

Faïz Gallouj
Clerssé, Université of Lille I and Ifresi

Abstract:

Drawing on the models of entrepreneurial and monopolistic innovation formalised by J. Schumpeter, this article proposes a new model of innovation in the Schumpeterian tradition entitled the interactional innovation model.

This micro-economic model, which reflects the role played on the macro-economic level by certain services in national innovation systems, links the following four elements:
- the various components (phases or activities) of the innovation process in which the service provider may play a part;
- the functions of the client firm that are the object of the innovation activity;
- the extent to which the service provider and client are involved in innovation, i.e. the extent to which innovation is co-produced;
- the cognitive forms of the service provider’s role in the processing and production of knowledge.

Thus the model highlights a certain number of configurations, among which the standard configuration (characterised by the absence of interaction and the mechanistic transfer of technology) is an extreme case.

Innovation in services, long neglected by economic theory, is currently becoming an established area of enquiry. This could hardly be otherwise in economies which are now largely dominated by services, whether that domination is expressed in terms of contribution to employment or to value added.

The growing interest in this issue is putting an end to a paradox: that of contemporary societies whose two main characteristics are said to be innovation and services but in which the service sector is, allegedly, impervious to innovation.

The explanation for this paradox is rooted in the history of economic thought, with the founders of political economy. It lies largely in the inertia of analytical tools conceived in and for industrial and agricultural economies. Adapting these tools to the specificities of services, and particularly to their often intangible and relational nature, produces two significant results. Firstly, innovation in services is shown not only to exist, possibly in a variety of forms, but also to play a not-insignificant role; secondly, various possible means of enhancing the ensuing industrial innovation are revealed.

The purpose of this paper is further to advance what might be called the “rehabilitation” of service activities in the economic dynamic. Indeed, services (or at least some of them, particularly the most knowledge-intensive), are no longer confined solely to innovating. Increasingly, they are becoming, at different times and in different ways, the medium for innovation in other spheres of economic activity, whether in manufacturing or in services.

In other words, this article is concerned not so much with innovation in services, as innovation by services, although, in reality, as we shall see, the two activities are indissociable, which raises considerable difficulties for the appropriation of innovation. This overlap between innovation activities in and by services is compounded by another difficulty, namely the problem of distinguishing between the routine participation of service providers and their actual contribution to innovation.

The recent literature offers a range of interesting analyses based around this theme of the role of services in clients’ innovations. There are, for example, a number of studies of the externalisation of R-D activities and of the role of “public intermediary agencies” in the dissemination of scientific and technical information. Studies devoted exclusively to consultancy in information and communications technologies seldom go beyond these issues (Djellal, 1995). Bessant and Rush’s analyses (1995), and those of Hales (1997), are concerned with the role of consultants in “technology transfer”, while at the same time extending the semantic content of the two terms a little: “transfer” is not limited to its linear dimension, nor “technology” to its material dimension. Finally, Miles et al. (1994) examine the various roles played by knowledge-intensive business services and describe these activities as users, diffusers and producers of innovation. On the macroeconomic level, Antonelli (1996) uses data from input/output tables and a methodology derived from the methodology of percolation processes in physics to analyse the role of informational and communicational technologies in improving agents’ “connectivity” (i.e. the number of connections established between agents in a network) and “receptivity” (i.e. their capacity to absorb information) through an increased use of knowledge-intensive business services.

The “consultant-assisted innovation” or, more generally, the “interactional or network innovation” model developed in this article aims to unify these analyses while at the same time opening up other perspectives, and in particular the possibility of extending the range and variety of mechanisms and forms of innovation. Moreover, the “assisted” or “co-produced” model of innovation represents a continuation of Schumpeterian and neo-Schumpeterian analyses. The (neo-Schumpeterian) definition of innovation as an activity leading to the resolution of “selected problems” (Dosi, 1982) is particularly compatible with the very purpose of consultancy activities, which is precisely to find preventative, curative or creative solutions to problems detected or (re)constructed in collaboration with the client.

In our view, this model extends, in an interesting and unexpected manner, the two models of innovation developed by Schumpeter in “The Theory of Economic Development” (1912) and

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2 On this point, see F. Gallouj (1994b); C. and F. Gallouj (1996); Gallouj and Weinstein, 1997, Sundbo (1997, 1998) and studies from the SI4S project, financed by the European Commission (program TSER, DG XII). The SI4S project, completed in June 1998, brought together ten European teams from Denmark, France, Germany, Great Britain, Greece, Italy, the Netherlands, Norway and Sweden to work for two years on the theme of innovation in and by services.

3 These less restrictive terms were suggested to us by J. Gadrey.

4 A similar hypothesis is developed in McKee (1990). See also Gallouj (1994b).
“Capitalism, Socialism and Democracy” (1942) and known subsequently as Schumpeter Mark I and II (see Phillips, 1971).

The interactional model of innovation is, as we shall see, a new locus for expression of the Schumpeterian notion of enterprise. In this sense, the model might be baptised Schumpeter Mark III or the “interface model of entrepreneurship”, to mark its affiliation with the Schumpeterian approach.

This article is divided into four sections. The first comprises a summary of Schumpeterian analysis. In sections two and three, the Schumpeter Mark III or interactional innovation model, its different components and mode of operation are introduced. In the last section, the theoretical implications of this model will be examined, including the difficulties involved in moving from a microeconomic model to higher levels of analysis (network, system), the risks of convergence between (national) innovation systems to which it may give rise and the risks of technological and cognitive lock-in as well as the problems of knowledge and innovation appropriation that are inherent in any such model.

1. Schumpeter and services

Schumpeter is interested in the general dynamic of capitalism, and there is no particular part of his work devoted solely to innovation in services. Two service activities, however, are a recurring theme: banking services, considered not as innovative activities, but as mediums for entrepreneurial activity, and retailing, which is cited on several occasions as an example of innovation (see, for example, Schumpeter, 1942, p. 124-125 in the 1963 French edition).

In other words, the considerable relevance of Schumpeter’s works for the service economy lies more in the implicit promises contained in his analyses, investigations and concepts than in actual studies and results.

These “promises” include:

- a particularly extensive definition of innovation, which, with a few adjustments, can easily be applied to services. According to Schumpeter, innovation is synonymous with combinations of knowledge resulting in new products, processes, and markets, or in new organisations and new sources of raw materials or semi-finished products;

- the concept of the “entrepreneur”, countless examples of which are constantly being produced by the service economy, which in turn encourages the belief that services may well be the last bastion of “romantic improvisation” in matters of innovation, an approach to technological innovation originating in manufacturing condemned by Callon (1994). This means that very simple ideas can still lead to the creation of economic empires, as is shown by numerous examples in retailing, catering, hotels and tourism.

These first promises are merely simple conceptual transpositions. Others are more subtle and require “more rigorous” extrapolation. Two such promises will be considered here, but only the second, which is the starting point for this article, will be developed in any detail.

- One of the subtler promises of Schumpeterian analysis is contained in the notion of the “wave of creative destruction”, which represents the replacement of innovative structures with non-innovative structures in the dynamic of capitalism. Indeed (and we shall confi
ourselves to asking the question without seeking answer it), are the phenomena of de-
industrialisation and tertiarisation that characterise our economies not, to some extent,
processes involving the destruction of manufacturing activities and the simultaneous creation
of services and governed by the laws of innovation (which, as it happens, favour the service
sector)?

- The second “promise” which we will attempt to formulate through our “interactional
innovation model”, emerges from the heart of the Schumpeterian analysis. Before being
developed at more length, this promise can be summarised as follows: Schumpeterian models
of innovation (both the entrepreneurial and monopolistic model) can be supplemented by this
new model (which did not exist or was of little importance in Schumpeter’s time, but is
consistent with his line of thinking) which accords an active place to services in innovation in
both the manufacturing and service sectors.

Indeed, the spirit of enterprise (i.e. the capacity to “combine” in order to find a way of
escaping from the static economic circular flow) is embodied in two successive (but not
mutually exclusive) models developed by Schumpeter: the entrepreneurial model and the
monopolistic model, which reflect the historical evolution of capitalism and of Schumpeter’s
thinking.

Let us briefly summarise the main characteristics of each of these models. The emblematic
figure in the entrepreneurial model (also called Schumpeter Mark I) is the individual
entrepreneur. Endowed with a gift for combinatory activities, the entrepreneur is not himself
creative but acts rather as a midwife in the process of transforming an (exogenous) invention
into an innovation. In the monopolistic model, the locus of entrepreneurial activity is a
specialist department (the research and development department in large firms). In both cases,
the introduction of the innovation triggers a Darwinian process of “creative destruction”
which undermines existing market structures, to the advantage of innovators and to the
detriment of their competitors, who are doomed to fail and disappear.

The transition from the entrepreneurial to the monopolistic model involves the (at least
partial) endogenisation of the innovation, i.e. a process of bureaucratisation that Schumpeter
(1942) denounces as a harbinger of the “twilight of the entrepreneurial function”, and thus,
eventually, of the disappearance of capitalism.

The Schumpeter Mark I model, like the Schumpeter Mark II model, can easily be
applied to service activities and firms provided that a more flexible interpretation of the notion of
innovation is accepted, but one that is not incompatible with the Schumpeterian spirit. For this
reason, the Schumpeter Mark II model may well manifest itself in the service sector, although
rarely in the form of an R-D department in the traditional sense but rather as a set of
formalised structures devoted to innovation (e.g. flexible project groups whose membership
cuts across department boundaries5).

This argument can ultimately be reduced to a simple conceptual transposition. Schumpeterian
analysis can be more radically transformed or extended by introducing what we have called
the “interactional innovation model” (or Schumpeter Mark III model, or interface model of
entrepreneurship).

5 Recent statistical studies confirm this result (see Djellal, Gallouj, 1998).
Just as the transition from the Schumpeter Mark I to Schumpeter Mark II model characterises the historical evolution of capitalism, so the appearance of our new model is, to a certain extent, an additional phase in this evolution. This phase, which Schumpeter could not have anticipated, coincides with the explosion of the tertiary sector and, in this general background, the advent of a knowledge-based economy, in which “grey-matter services” or “complex services” or even “knowledge-intensive services” constitute the second knowledge infrastructure, which complements and competes with the public knowledge infrastructure made up primarily of public education and research services (Bilderbeek, Den Hertog, 1997).

As we shall see, the advent of this “interactional innovation model” establishes a more flexible and open definition of innovation and provides a new locus for expression of the Schumpeterian spirit of enterprise. This model, along with other mechanisms (e.g. the implementation of organisational concepts such as the various forms of “intrapreneurship”, i.e. modes of organisation that create spaces in which freedom and creativity, the internal spirit of enterprise, can flourish), has probably played a role in the struggle against the bureaucratisation of the entrepreneurial function which Schumpeter feared. Indeed, it opens up the firm to the external environment and encourages the renewal of organisational routines.

2. Schumpeter III: the different components of the interactional innovation model

Our model has three components: the innovation and the two actors who produce or introduce it, i.e. the “consultant” and the client. These three terms must be defined before they are brought together and the various possible configurations of the interactional innovation model examined.

2.1 Innovation: definition and “objects”

As has already been noted, Schumpeter developed a wide-ranging typology of innovation but usually used only a restricted version of it (technological innovation). Schumpeter’s two models are, indeed, “science-push” models. In the Schumpeter Mark III model, a resolutely broad and open definition of innovation, inspired by the evolutionary approach, will be adopted. Innovation will be defined as a “problem-solving activity” covering the whole range of a firm’s problems (or functions), whether they are considered independently of each other, or in terms of the interactions between them. Some of these problems are, of course, technological in nature, but there are also social, legal, fiscal, marketing and strategic problems, among others. With the exception of technological problems, the solutions to which are described as technological product or process innovations, resolution of these different problems is generally treated in two different ways by economic theory.
- They are denied the status of innovation, even when the solution or solutions to the problem are original and unprecedented, in order to preserve a degree of “operationality” in the concept. At the most, they are considered as “change”.
- All (or a large part of) the problems and corresponding solutions are grouped together in a “catch-all” category labelled organisational innovation.

Schumpeter’s typology (product, process, organisation, market, raw material or semi-finished product) is useful from this point of view, provided that some semantic adjustments and extension are accepted. For example, product innovation and process innovation cover both

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6 By analogy with terms traditionally used in economic analysis “capital-intensive” and “labour-intensive”.
tangible products and processes and intangible products and processes (e.g. a new type of consultancy or a new field of expertise in consultancy, a new type of hotel or holiday package, a new method, etc.). Furthermore, it is important to introduce into the notion of product innovations a category which we have elsewhere called ad hoc innovation (C. Gallouj and F. Gallouj, 1996), which denotes tailor-made and co-produced innovations, as well as novel (and not necessarily directly reproducible) solutions to a given client’s problem.

Another way of looking at innovation, which does not necessarily contradict that outlined above, is one that focuses on the various functions (Fj) within the firm that may be the object of innovative activity. From an evolutionary perspective, a function can be defined as a set of activities (occupations, specialisms or competences) based on a common disciplinary or cognitive field and associated with particular tangible technologies (machines) or intangible technologies (methods). Each of these functions can be associated with its own “production function”. The different functions in question are well known to researchers in management, whose fields of inquiry and research programmes are, to a certain extent, structured around them. To give just one well-known example, it could be said that they are highly formalised and articulated in Mintzberg’s organisational configurations (1982). Mintzberg makes a distinction between technostructure functions (management, finance, logistics, IT, training, etc.), support functions (human resources, communications, marketing, legal, etc.) and infrastructure functions (maintenance, security, catering, etc.).

It is this functional approach, which is generally absent from economic analyses but often seen in management sciences, that will be emphasised here, for various reasons.

- It allows consideration to be given to innovation in all its variety: legal and fiscal, IT, financial, marketing, strategic, logistical innovation, etc., without neglecting those “objects” of innovation located further downstream that are more frequently examined, i.e. product and process in the strict sense. Innovation can affect any of these “objects” or on different combinations of objects. Indeed, an innovation (innovation project) often brings several functions or specialisms into play. Thus legal and IT functions can be seen to be operating simultaneously when, for example, a new software application is designed, and specific means of protection are considered.

- It sheds light on the black box of “organisational innovations” and process innovations, if it is accepted that they are defined, as noted above, by simultaneous changes in various functions of the firm: human resources, IT, marketing, communications, etc.

- The various internal functions of the firm can be compared with the corresponding external service providers in order to conduct a more detailed examination of innovation processes (the legal function with legal consultancy, marketing function with marketing and market research consultancy, etc.). These internal and external functions belong to common disciplinary fields and share a common stock of knowledge.

2.2 The stages of the innovation process

In order fully to understand innovation phenomena, it is not enough to analyse the object of innovation (product, process, or, further upstream, the different functions considered autonomously or from the point of view of their relationship with the new product or process). It is also necessary to examine the process itself. Indeed, innovation, just like services themselves, is not an outcome, but an interactive process comprising various activities, which,
for simplicity’s sake, we will limit to the following (bearing in mind that one preliminary stage is the realisation of the possibility or need for innovation)\(^7\).

- **The gathering of information and ideas on a problem.** The information gathered and transmitted is not limited to scientific and technical information. It may be any kind of information about any of the functions envisaged. This extended definition of information marks a significant break with the Schumpeterian models (Marks I and II), which are often described as “science-push” models, since innovation in these models is very much determined by scientific and technical information and knowledge which are completely exogenous in model I and partly endogenised in model II. Taking the client firm as a reference, the information gathered may be internal or external (i.e. it may relate to the firm’s internal or external environment). Information may be collected informally and unconsciously or in a more formalised way. The gathering of external information, for example, can be formalised in monitoring functions that focus not only on technological and commercial development but also on the whole range of functions in the firm that may be potential media for innovation. The gathering of internal information by members of the firm or by (or in collaboration with) external service providers can also be associated with the activity of problem formulation (diagnostics) that may be a source of innovation.

- **Research (basic or applied)** in the usual sense of the creation of new knowledge (by combining various stocks of old knowledge). In our view, however, this activity can involve both the exact sciences and the social and human sciences (law, sociology, psychology, economics, management techniques, financial techniques, etc.).

- **Conception and development (C-D)**, i.e. the mobilisation of the various ideas gathered or produced as a solution to the problem detected. This activity also includes the test and experimentation phases.

- **Production of the solution** which, in services, is generally inseparable from its commercialisation in that it is co-produced, i.e. the client participates in the production process.

- **Marketing of the solution.** This may take place externally, and in that case would involve the diffusion of the innovation. This phase might also include the establishment, downstream of the process, of various mechanisms (legal or otherwise) intended to protect the innovation. However, this marketing may also be internal. In this case, the innovation would be “sold” to “internal clients” of the innovating organisation. This in fact would be a case of “pseudo-marketing” since, with the odd exception, there is no real organised market, but rather bargaining on the contribution to be made and the ensuing recompense. In other words, this phase brings into play all those mechanisms that play a part in the internal implementation or simply in the introduction of an innovation (training, learning mechanisms, etc.) and which are intended to create the conditions under which the innovation can adapt to its new environment, i.e. become “localised” and “contextualised”.

These various activities are not successive phases in a rigid and linear process. Rather, they should be considered as a set of tasks that can be carried out in the course of an innovation.

\(^7\) For a concrete examination of innovation processes in different service activities (consultancy, banking and insurance, electronic data services) see Gadrey J. et al (1993, 1995).
process. The gap between this perception and a standard linear vision of the innovation process can be gauged by the following more general observations.

1) These various activities concern not only technological innovation in the traditional sense, but all innovations, whatever the medium. For example, a problem within the legal function may well bring some of these activities into play, since the search for solutions may include an information and idea-gathering phase and more conceptual analytical phases that resemble genuine R-D (such tasks are, moreover, entrusted to legal experts, some of whom hold a PhD) and requires strategies for appropriation and protection.

2) An innovation process may involve all these activities, or may be briefer and limited to only some of them.

3) The activities may follow on from each other (sequential process), but usually they overlap and some may take place simultaneously.

4) They may be formalised (institutionalised) in a “script” of the innovation process, but are more generally informal and tacit.

5) The service production process may be a stage (or activity) in the innovation process. In some cases, however, these two processes may also merge into one. Indeed, although innovations usually have a certain degree of exteriority in relation to the actors (in the case of clearly identified innovation processes developed by clients and for which service providers are being sought), there are also innovations which are not planned, which emerge from the process of producing the service and which are recognised as such only after the event. This is the case with what we have termed “ad hoc innovation”.

2.3 Consultancy, the client and the degree of co-production

Consultancy itself is a problem-solving activity, as is borne out, for example, by the traditional definition formulated by Greiner and Metzger (1983): these are “services provided to organisations by specially trained and qualified persons who assist the organisation, objectively and independently, in identifying and analysing problems, recommend solutions to these problems and help, when called upon, to implement those solutions”.

There is thus some common ground between consultancy and innovation, and boundaries will have to be fixed. Indeed, not every consultancy service can be considered an innovation activity, so the boundary between routine consultancy transactions and innovations must be established.

Furthermore, our interactional innovation model is not limited to the particular category of consultants generally called “innovation consultants”, a term used to denote specialised activities permanently directed towards a clearly defined innovation (a client’s innovation project). For example, “innovation consultancy” in the strict sense would include the work of a patent consultant but not that of a specialist tax lawyer (although the latter can, as we know, play an active role in devising a new insurance contract). Our model goes further in that it seeks to take into account all consultants and consultancy services that may play a part in a client’s innovation, whether the innovation exists a priori or emerges from the process of service provision.
Nor is this model limited to services provided by professionals and firms belonging to the consultancy industry as defined by accounting classifications. It encompasses all knowledge-intensive business services, as well as the services provided by R-D laboratories, universities, public intermediation agencies, financial and insurance companies and, finally, inter-firm cooperation in matters of innovation.

It can easily be generalised to include an organisation’s internal service providers and consultants. Thus it is a model that can apply to numerous situations involving intermediation.

“Consultancy” can be brought to bear on all the functions of a firm. Although space precludes any outline of them here, numerous typologies exist of the whole range of “problems” for which consultancy activities may provide a possibly innovative solution (legal, strategic, communications consultancy, etc.).

Consultants may act alone or in collaboration or competition with others in the different phases of the innovation process defined above. Thus the aim of their actions may be information or idea gathering, problem formulation (diagnostics), the design, development, testing, production and implementation of a solution, the management of innovation projects, protection and training measures, etc.

Furthermore, the part played by consultants and, conversely, by their clients in these various tasks can take different forms, which can be classified by the extent to which the innovation is co-produced. The level of co-production can be zero or very low (e.g. a simple subcontracting situation in which the service provider has a relatively clearly defined brief involving little interaction with the organisation’s internal experts). However, it is usually high, which means that the intensity of work at the interface is also high, with the innovation being produced by a partnership between internal experts and external service providers. Thus for those concerned with innovation, the notion of co-production in the service economy is echoed in the concepts of partnership, collaboration, and learning by using or interacting (Von Hippel, 1976).

2.4 The cognitive forms of the service provider’s role in innovation

Another way of looking at the role of consultants in the innovation process, and one which is more important for our present argument, is to examine their various relationships to information and knowledge (whether embodied or not), i.e. the various cognitive procedures used by service providers in the innovation process or the various modes of intellectual processing and production of knowledge.

A consultant’s role may, indeed, be limited to the algorithmic or linear transfer of information and knowledge that may be embodied in humans or technical systems (technological transfer). This mode of activity seems to occupy an important position in certain areas, such as marketing research, for example. This concept of consultancy is derived from a standard perception of technological information as a quasi-public good, i.e. as a non-excludable, non-appropriable or non-rival good, which can be transferred easily and at low cost (Arrow, 1969). However, an activity limited to this algorithmic (or linear) transfer function seems to us, by virtue of the hypotheses underpinning it, to contradict the very existence of consultancy activities. Indeed, the fact that these activities exist, and at a not-

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8 These two terms being, in this case, synonymous.
9 I.e. third party access cannot be prohibited.
10 I.e., their use or consumption by a given agent does not rule out their use or consumption by another.
inconsiderable cost, proves that information is not “merchandise”, accessible at low cost, omnipresent and easily transferable. However, other relationships to information and knowledge (or more precisely the transformation of information into knowledge)\(^{11}\) can be brought to light. These intellectual processes of knowledge production and transformation fall within the Schumpeterian and neo-Schumpeterian tradition:

- **(Creative) combination**: the aim here is to create links, not only between information and knowledge, but also between people or organisations. Various activities can be described through this mechanism:
  - R-D, which consists of creating new knowledge by (creatively) combining old stocks of knowledge;
  - searching for partners, which involves a combining of organisations;
  - the role of “marriage broker”, to use the term coined by Bessant and Rush (1995), which also involves a combining of organisations, but in this case a consultant is appointed the prime contractor, with responsibility for “recruiting” organisations and managing the interaction between them.

- **Knowledge localisation, contextualisation or “customisation”**: i.e. the transformation of standard (generic) information into tacit and idiosyncratic knowledge adapted to the client’s particular situation, making it appropriable by the client but not readily transferable to others. “Localisation” thus transforms generic information or knowledge into quasi-private goods (Antonelli, 1995; Atkinson and Stiglitz, 1969; Petit, 1998).

- **Knowledge formalisation** which consists, conversely, of making knowledge more objective, less tacit and more transferable, i.e. generic, by constructing or integrating it into a social context. This is a genuine maieutic function. The formalisation of a problem and establishment of a diagnosis may also fall within the scope of this mechanism which, in this respect, has similarities with the “translation” mechanism of network sociology (Callon, 1986), i.e. the “enlistment” of real or potential actors to help in defining the problem. Indeed, the definition of the nature of the problem is not “self-evident” but largely socially constructed.

- **Learning (or unlearning)**. This innovation mechanism must be considered in all three of its aspects: “learning oneself”, “teaching others”, i.e. clients, through formalised processes (training) or non-formalised processes (learning by interacting), as well as “teaching others to learn”, i.e. maintaining and improving what Cohen and Levinthal (1989) call firms’ absorptive capacities.

It is clear that the various mechanisms through which the “consultant” shapes and fashions “knowledge” must be considered both positively and negatively (Table 1). Thus, the opposite of combination is dissociation, i.e. the destruction of links between knowledge, organisations, etc., that of learning is unlearning, i.e. the destruction of obsolete knowledge while that of localisation (i.e. knowledge contextualisation) is formalisation (i.e. the codification of knowledge, which creates the conditions under which it can be transferred).

\(^{11}\) In other words, these two terms are no longer considered to be synonyms, since, in this case, knowledge is information which has been sifted, processed and contextualised by intelligence.
### Modes of knowledge processing and production of knowledge

<table>
<thead>
<tr>
<th>Modes of knowledge processing</th>
<th>Opposite</th>
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<tbody>
<tr>
<td>Combination, association</td>
<td>Dissociation</td>
</tr>
<tr>
<td>Learning</td>
<td>Unlearning</td>
</tr>
<tr>
<td>Localisation, contextualisation, customisation, creative adaptation</td>
<td>Formalisation</td>
</tr>
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**Table 1:** The main modes of the intellectual processing and production of knowledge

The positive or negative nature of a given process does not imply any value judgement: unlearning, for example, is not a disease within a firm but is, on the contrary, a mechanism whereby it can escape from “competency traps” (Levitt and March, 1988) in order to implement new learning trajectories. It is thus an example of creative unlearning.

Thus each of the facets (positive or negative) of a given process can manifest itself independently, but they can also precede or succeed each other. Thus, learning can follow unlearning and a network can be reconstructed following the break-up of the previous configuration.

Some of these modes may be stages in a sequential process: for example, knowledge may first be formalised so that it can subsequently be combined more easily and finally transferred.

In conclusion, these various modes of processing and producing new expertise are not specific to situations in which an external service provider has a role. Any processing and production of knowledge, whoever the actors may be, can be considered in the above terms. Our interactional model of innovation does not, therefore, apply solely to consultants or, more generally, to external service providers but can also describe the activity of any internal researcher or innovator as well.

### 3. The innovation model as an interactional process

Innovation relates to a function. It presupposes a certain mode of relationship with the client and an intellectual approach to the processing of knowledge. In general terms, the interactional model of innovation can be formalised by articulating the following four elements (see Figure 1):

1) the components (stages or activities)\(^{12}\) of the innovation process in which the service provider may play a part (I);

2) the functions (F) in the client firm that are the object of the innovation activity. This may be any function (or combination of functions) in the firm, and not only those that play a part, downstream, in the design of a new product or process;

3) the degree of involvement of the service provider (and client) in the innovation, i.e. the degree to which the innovation is co-produced (C);

4) the cognitive forms taken by the service provider’s role in the innovation process, i.e. his way of processing and producing knowledge (M).

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\(^{12}\) In reality, these are “phasets” or sub-processes.
3.1 Description of the model

If, firstly, the relationships between vector I (activities or stages in the innovation process) and the other components of the model are examined, the following observations can be made:

- The multiple combinations possible between the various stages or activities in the innovation process and the various functions in the firm (relationship 1 in Figure 1: \{I_i\} \rightarrow \{F_j\}) represent the functions or groups of functions affected by the innovation (or by certain stages or components of the innovation).

Thus innovation (the process in its entirety or some of its stages) can relate to any function or group of functions Fj independently of any product or process innovation, and not only to the “functions” corresponding to the new “product” or “process”.

If it is assumed, for example, that I1 represents the gathering of information and ideas, I3 the development stage (or, more precisely, the conduct of a test), F1 the legal function and F5 the insurance settlement function, then:

- the relationship I1 \rightarrow F1 denotes “the search for information and ideas for a problem relating to the legal function”;
- the relationship I3 \rightarrow F5 means that a test is carried out in the insurance settlement function.

- The combinations \{I_i\} \rightarrow \{C_k\} (relationship 2) represent not the degree of co-production in the service but rather that in the innovation (or some of its stages), although, as we have already pointed out, the two processes are inseparable from each other in certain cases, in that the innovation can “emerge” from the service provision process. The degree of co-production can vary from one task to another (e.g. it can be low for I1, information gathering, but very high for I3, development).
- Combinations \{I_i\} \leftarrow \rightarrow \{M_1\} (relationship 3) represent the various forms taken by the service provider’s intellectual input into the various stages of the client’s innovation process. Thus, \(I_1 \leftarrow \rightarrow M_1\) symbolises the simple mechanical transfer of information and ideas and \(I_3 \leftarrow \rightarrow M_3\) the production of new knowledge (R-D activity based on the creative combination of old stocks of knowledge).

### 3.2 Different configurations of the model

If we confine ourselves for the moment to the role played by a single consultant, the interactional model of innovation offers a considerable number of combinations \{[I_i], [F_j], [C_k], [M_1]\}. Thus, the multiple combinations of the different vectors, the components of which can themselves also be combined, make it possible to conceive of a very large number of “co-produced” innovation spaces.

This general model cannot be reduced to a few stable, clearly identifiable configurations. However, a standard configuration of the model can be contrasted with a (generic) configuration which will be termed “evolutionary”.

The standard configuration is stable and easy to identify. It constructs a clearly delimited single innovation space (see Figure 2). Indeed, for each of the sets \{C_k\}, \{M_1\}, the choices are reduced to unity:
- there is zero co-production (C0) since there is little if any interaction between the service provider and the client. This is in fact a subcontracting or jobbing relationship;
- the mode of processing this technological knowledge is simple mechanical transfer (M1).

For sets \{I_i\} and \{F_j\}, however, the choices are numerous:
- the functions \(F_j\) in question are those required to produce new goods or services, if the object of the innovation is that good or service. More generally, the object of the innovation could be any function or set of functions, independent of any goods or services;
- as far as the innovation process is concerned, once again, different “phases” \(I_i\) or groups of “phases” may be involved.

These various operations relate to an innovation process considered to be linear, i.e. one in which the various activities are independent of each other (no interaction or feedback).

It is important to note that the two basic components of the standard configuration are the absence of interaction (C0) and the mechanical nature of the transfer (M1).
In other words, in the standard configuration, the model is reduced to the transfer of codified (technological) information, with the intention feeding into one or other or all the stages of the innovation process, without any coproduction whatsoever, i.e. without any interrelation with the client. A typical example of this standard configuration is the transfer of technology (turn-key projects) to developing countries, in which some consultancy and engineering firms have distinguished themselves and which has sometimes resulted in resounding failure. However, it is important to remember that this form of transfer can also involve non-embodied technologies, management systems, methods, cognitive families and functions.

However, the standard configuration is only an extreme case of our model, which allows many other configurations or “states” to be envisaged. Since evolutionary theory is concerned with systems that have a wealth of interactions (Coriat and Weinstein, 1995) and variety (Saviotti, 1996; Metcalfe and Gibbons, 1989) and introduces multiple modes of intellectual knowledge processing, all co-produced innovation spaces where transfer is not limited to its simple mechanical form can be considered as evolutionary configurations. Irrespective of its “state” at any given moment, the model always presupposes that the knowledge tapped or produced is transferred (to the client) but that this transfer is accompanied by a more or less complex series of manipulations and processing operations (contextualisation, formalisation, association, etc.).

Since it does not seem possible to reduce to a few typical cases the immense diversity of evolutionary configurations that the interactional model of innovation can take, we will limit ourselves to providing a few examples of configurations which illustrate this diversity (and which we have observed in surveys: Gadrey et al., 1993; Gadrey and Gallouj, 1994; Djellal et al., 1998). In order to simplify the graphical representations, the different configurations for a given function or group of functions are considered.

1) The co-produced innovation space delimited by the set \{I_1, I_2, CO, M_3, M_4\} (see Figure 3) can denote, for example, the co-production of a solution to a problem relating to the legal function, which we have elsewhere called ad hoc innovation (Gallouj and Gallouj, 1996). I_1 and I_2 represent, respectively, the gathering of information and ideas and an analytical and conceptual activity comparable to R-D, CO, a high degree of coproduction and M3 and M4 processes of knowledge contextualisation and combination. In this configuration of the model, innovation cannot be envisaged independently of the process of service provision and the actors involved. It is constructed as the service itself is provided.
2) The role of a consultant in the drawing up of an insurance contract (and, more precisely, in the test phase of this new contract) is illustrated in Figure 4. This is a frequent configuration in services, one that might be called the “consultant-assisted test” configuration. It is delimited by sets \{I_3, C_1\} and \{M_1\} in which I_3 represents the test phase, C_1 a degree of co-production or interaction greater than zero and \{M_1\} the whole range of knowledge-processing methods;

![Figure 3: Ad hoc innovation configuration](image)

3) The externalisation of R-D, i.e. the use of external laboratories (public or private), universities or grant holders, also falls within the scope of our interactional model of innovation. Occasionally, it can operate according to the standard algorithmic configuration (subcontracting and mechanical transfer), but more usually in the interactive mode. The stages in the innovation process involved here are the research and development phases (I_2 and I_3) and the knowledge processing methods used can be any of \{M_1\}. One of the variants of the model of R-D externalisation is illustrated in Figure 5.

![Figure 4: Consultant-assisted test model](image)

![Figure 5: A variant of the model of interactional R-D externalisation](image)
3.3 Model of innovation assisted by (several) consultants

The model can be made more complex by having several consultants contribute to an innovation. Once again, a large number of configurations are conceivable. For the purposes of illustration, we will limit ourselves to the following four, only the first two of which are represented in Figure 6:

- the configuration in which a single innovation or stage in the innovation process depends on several consultants (operating competitively or cooperatively, and with varying degrees of interaction) to solve a problem relating to a single function. The participation spaces of the different consultants overlap to varying degrees, depending on the type of interaction implemented and the knowledge-processing method used. In configuration 1 in Figure 6, the types of interaction and knowledge-processing methods are identical for the different consultants;

- the configuration in which, for a problem relating to a given function (Fj), or group of functions, which may be autonomous or linked to a wide-ranging product or process innovation project, different consultants are required for the different stages in the innovation process. For an important technical process innovation project, for example, a firm might have recourse - at the same time or at different moments in time - to marketing and monitoring specialists to gather information, knowledge and ideas, one or more university laboratories to solve technical R-D problems, a project management consultant to manage the innovation project and integrate the various participants; a patent consultant, etc. (see configuration 2 in Figure 6);

- the configuration in which a different consultant is mobilised for each function. This configuration differs from the one in which most of the problems relating to the different functions can be tackled by the same multi-specialist network consultancy firm;

- the configuration in which a consultant calls upon another consultant for assistance. This configuration could be termed “consultant-assisted consultant” (e.g. an academic).

Figure 6: Various configurations of the model of innovation assisted by (several) consultants

4. Theoretical implications of the interactional innovation model
The interactional innovation model raises a number of interesting theoretical issues which will now be examined.

4.1 Beyond the micro-economic (service) relationship: system and network

This article has thus far placed the emphasis on interactional innovation as a micro-economic relationship. But the model can be understood only if it is relocated in a wider system of meso or even macro-economic relationships that determine the way it operates. Our purpose here is not simply to engage in economists’ usual examination of the difficulties involved in aggregating micro-economic elements in order to proceed to higher levels of analysis. These higher levels play an essential role in the operation of the model and in its production function.

Thus the meso or macro-economic effects of such a model also find expression in the roles played by consultants and, more generally, by knowledge-intensive business services in innovation systems and (extended) technico-economic networks. The evolutionary approach to the economics of innovation and the sociology of innovation and networks are closely akin to each other in this respect, in that they both take interaction between agents as their starting point. Thus consultants are both elements (nodal points) in local, regional and national innovation systems (Lundvall, 1985, 1988) or technico-economic networks (Callon, 1991) and also, and above all, vectors instrumental in the establishment of relationships between agents. They create links, what Granovetter (1973) calls “bridges”. They maintain “strong ties” with their clients but their principal value lies in their ability to exploit to their clients’ advantage more tenuous links, links weakened by the various (additive) forms of “distance” vis-à-vis the clients in question. This “distance” may be temporal (we came across a similar problem a while ago), sectoral or functional (we came across a similar problem in a completely different sphere), geographical (we encountered this problem in a different country) or even symbolic (networks of grandes écoles in France).

Thus consultants (and in many case internal experts as well) can be seen as entities where three types of network intersect (Decoster and Matteaccioli, 1991):

- international business networks, which are the media for the transmission of information from other geographical spaces. These networks can take different forms (networks of correspondents, subsidiaries, etc.). When these “correspondents” support the consultant or bring specialist experience to bear, we could be said to be dealing with a reflexive model that constitutes a particular variant of the general model, i.e. the “consultant-assisted consultant model” already referred to above;

- institutional diffusion networks: relationships with public authorities;

- prestigious academic networks: relationships between consultants and the most famous universities or the grandes écoles (in France) and between the graduates of those institutions.

In (extended) technico-economic networks, consultants can be actors not only in transfer zones but also in central zones (scientific, technical, market poles), to use the distinctions

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13 This extension is carried out to integrate innovations which are non-technical or mainly non-technical.

14 The strength of these ties is partly expressed by the degree of coproduction in our model \{Ck\}.
made by Callon (1991). Thus internal and external consultants can be classified according to their area or expertise, whether it be science, technology or the market, or the transition from one area to another. Consultants also play a role in the morphology and dynamics of the technico-economic network. Thus they are able to play a part in reconfiguring or extending the network by adding other actors, whether in a real or virtual way (i.e. by mobilising “weak ties” in their production function). They can also facilitate the process of “translation”, in the sense of the term used in the sociology of networks (Callon, 1986), and contribute to network convergence (i.e. to the free flow of information, knowledge and solutions within the network).

4.2 Interactional innovation and the convergence of innovation systems

This paper advances a view of the service provider and the service relationship as an expression of the Schumpeterian spirit of enterprise, made available to clients or activated by them. In other words, “consultants” are regarded as “extra cognitive memory” for firms which are now defined not as production functions but as “learning organisations”. Our hypothesis is that they maintain economic diversity, what might be called, by analogy with “biodiversity”, “eco-diversity” or “socio-eco-diversity”, and that they activate the processes of knowledge production and organisational learning (at least if their brief is successful).

However, just as Schumpeter feared that the endogenisation of the entrepreneurial function in R-D departments threatened by bureaucratic inertia would eventually lead to the stifling of the engine of capitalism, it is possible to advance a view of consultants as factors in the convergence and increasing irreversibility of innovation systems, i.e. in the eventual reduction of the degree of variety in those systems. In this scenario, consultants have a damaging effect since their actions lead to decreased eco-diversity (to the extinction of economic species, as it were). In the long term, economic systems would become increasingly uniform through the application of the same technical systems, types of organisation, management systems, as exemplified in the international diffusion of accounting, financial, recruitment and management norms, “lean production”, etc. This “cognitive” convergence is said to be taking place already, through the intermediary of international consultancy networks of Anglo-Saxon origin. In France, some sociologists (Henry, 1992) attribute this convergence to endogamous economic behaviour generated by the uniquely French system of producing and reproducing elites through the grandes écoles. The risk of network lock-in is thus the principal “weakness of the strong ties” thus created, to use A. Grabher’s terms (1993).

If it is assumed that economic variety is preferable to uniformity, a number of arguments can be put forward that may help counter this risk of convergence (as a dominant trend):

1) The first argument relates to the “localised” or “contextualised” nature of the knowledge, know-how and innovations co-produced and diffused by consultants. As has already been stated, this knowledge is often “reconstructed”, since it tends to lose its shape on contact with different firms, defined as multidimensional economic spaces (Antonelli, 1996)\textsuperscript{15}. As it comes into contact with the various points in these spaces, it is subject to displacements and deflections. Furthermore, these spaces, which might more appropriately be called multidimensional socio-economic spaces, are not static but fundamentally dynamic. They change over time, which is a source of eco-diversity. This accords with several theories in

\textsuperscript{15} According to this author, the main topological dimensions of these economic spaces are: the scientific space, the product characteristics spaces, the consumption space, the function externalisation space, the inter-industry relations space as defined by input/output tables, the work space, the geographical space, etc.
spatial economics, according to which the spatial diffusion of a dominant mode of organisation on a worldwide scale does not homogenise the space; on the contrary, it diversifies as it comes into contact with specificities (historical, cultural, economic, etc.) and with the specific dynamic of innovation at work. Spatial diffusion gives rise to as many different innovation trajectories as there are innovative “environments” (“milieux”) (Aydalot, 1996, Gordon, 1990, Decoster and Matteaccioli, 1991). This same idea appears in recent studies from the French regulation school. That “industrial models travel in search of favourable spaces and are transformed by them” is one of the main conclusions of “Le monde qui va changer la machine” (The world that will change the machine) (Boyer and Freyssenet, forthcoming).

2) The power of clients (especially the largest ones) and their cognitive qualities must not be underestimated. The risk of convergence is a function of the balance of power and mutual influence between the client and the service provider. A subcontracting relationship can more easily lead to convergence in the long term, i.e. the standardisation of products, processes and methods etc. There can be a great (Procrustean) temptation to make all problems fit the existing solutions. However, a more interactive relationship, which takes greater account of clients’ specificities and their internal and external environment, will be, on the contrary, a source of diversity and new solutions, since the situations are themselves always new. Under pressure from clients (i.e. when they have sufficient knowledge to make their “voice” heard, to use Hirschman’s term (Hirschman 1972)), consultants make efforts to “localise” their information and knowledge so that they adapt them to the “need” at the same time as “reconstructing” that need. Co-production enables the client to leave his specific personal mark on the knowledge. It is a factor in syncretism and hybridisation, both mechanisms that encourage eco-diversity. Furthermore, the client in an innovation project can call on several consultants and have them work cooperatively or competitively in order to ensure a measure of diversity.

There is undoubtedly a greater risk of convergence in the design and introduction of technical artefacts than in more malleable, intangible solutions. Even those consultants most involved in handling technical artefacts (e.g. information and communication technology consultants) are guided less by deterministic technological trajectories than by socio-technical trajectories which establish a balance between the technical, organisational and social dimensions (Djellal, 1995). In other words, since the physical equipment cannot be separated either from the software or from the social environment, the risk of convergence inherent in technical systems is reduced.

3) Consultants’ own capacity for innovation must not be underestimated either. This is a source of diversity and of differentiation from competitors. Consultants’ capacity for innovation enriches their contribution to their clients’ innovation, and reduces the risk of convergence. Even if consultants are instruments of the “laws of imitation”, it should not be forgotten that the universality of these laws (as defined by Gabriel de Tarde, 1890) can take a paradoxical turn: to imitate is also to differentiate or to do the opposite of the object of imitation. In other words, benchmarking does not exist, or only as a “mobilising slogan” within firms, since “it is not innovation that changes the world but the world that changes innovation”\(^\text{16}\). In consultancy, moreover, the existence of “networks” on different levels creates “distortions” in the transfer process that alter the nature of the knowledge being

\(^{16}\) These remarks are borrowed from Robert Boyer, Clercé Seminar, 28 May 1998, Lille.
transferred. The more extensive the network, the lower the risk of convergence becomes. Indeed, there is loss, selection and distortion of knowledge during its entire progression through the network’s internal spaces.

4) Unlike the Schumpeter Mark I and II models, which are “science or technology push” models, interactional models of innovation offer a balance between the science-push and demand-pull approaches. Indeed, clients and their needs (formalised by the support functions [Fj] or “objects” of the problem to be solved and by the intensity [Ck] of the client/consultant relationship) are a central element of the model. It must also be noted that this model enriches the content of the scientific determinant in that it also takes social and human sciences into account. This determination by science (understood in a wider sense) and demand is also a source of variety which limits the risks of convergence.

4.3 Consultants and the risks of technological and cognitive lock-in

This problem is closely linked to that of convergence discussed above. Either voluntarily (to secure customer loyalty) or involuntarily (because of expertise differentials), consultants and the consultant-assisted model of innovation can lead to technological or cognitive lock-in, i.e. cognitive dependence and complementarity phenomena that are disadvantageous to the client or system. The notion of lock-in is understood here in a wide sense. Thus, for example, a legal consultant could put together a legal and fiscal arrangement of such complexity that nobody else would be able to find their way around the maze. This problem is more familiar, if not more common, when physical technical systems or software are involved (e.g. computer consultancy). Methodological lock-in (in the case of intangible technologies) is also common.

However, it should be noted that this lock-in phenomenon may, conversely, work in favour of the client himself, when it is the consultant who is subordinate to his client, i.e. when the balance of cognitive and technological power is tilted towards the latter.

4.4 The appropriation of co-produced innovation

A service provider’s participation in the production of a client’s innovation raises serious problems of appropriation. The difficulty of appropriating innovations makes itself felt both positively and normatively. It is technically difficult, even impossible for the service provider or the client to protect the innovation, which is very often a service innovation (relating to the service functions of manufacturing or service firms). This is the usual difficulty of protecting intangible and relational activities.

This positive or technical difficulty (absence of legal methods of protection) is compounded by another, which might be described as a normative difficulty in that it concerns the sharing of the rights of ownership over a co-produced innovation. Do the co-produced innovation and the knowledge stemming from the co-production process belong to the client or to the service provider?

Different arguments can be put forward:

- In the case of the standard configuration of the model, the problem of the appropriation regime does not arise, as the information and knowledge do not belong to the innovator. As public goods, they are non-rival and non-excludable, i.e. they cannot be appropriated by the innovator.
- More generally, the knowledge is shaped in such a way as to be adapted to the “topology of a multidimensional socio-economic space”. This is localised knowledge that lies outside the mechanical universe of information and knowledge as (non-excludable and non-rival) public goods that are both transparent and transferable. Information and knowledge derived from the interactional model of information are knowledge adapted to the client’s socioeconomic problem and thereby become quasi-private goods (i.e. excludable and rival). They thus acquire a significant “local” and idiosyncratic character, which limits their transferability and facilitates their appropriation by the client. On the other hand, non-localised (raw) information (generic information) can be considered a public good: the service provider can make use of it and “localise” it elsewhere without harming previous clients.

- Given the nature of innovation and the rise to prominence of new innovation models (recombination or architectural model), the problem or issue increasingly seems to be not the protection of knowledge but rather the mechanisms likely to facilitate its diffusion (Foray, 1993). Consultants are thus “spillover” factors that may help to establish a social optimum.

4.5 Is the interactional model of innovation consonant with the notion of “waves” of creative destruction?

Consultancy activities may help both to keep clients in the “circular flow” (i.e. prevent a firm from disappearing in the turmoil of creative destruction) and to facilitate their exit from it (i.e. through innovation). They can keep the client in the “circular flow” in two different ways: by departing from their own circular flow (i.e. by innovating) or by staying in it (more routine service provision).

Consultancy can also be seen as an activity which artificially keeps (or seeks to keep) moribund firms in the economic circular flow, although Darwinian mechanisms of “creative destruction” should lead to their disappearance. Thus it could be said that the consultant-assisted model of innovations runs counter to the Schumpeterian dynamic of waves of creative destruction. This is consultancy in its role of provider of solutions to “curative problems”, i.e. consultancy as therapist, when, in actual fact it plays just as large a part in “preventive” and “creative” problems.

Whatever the type of problem considered, there is in reality no contradiction with the Schumpeterian spirit, since it is not possible to speak of an assisted innovation model unless the consultant introduces an innovation or participates in an innovation which prevents the client from disappearing. When the consultant is involved in the provision of routine services, we are not dealing with the assisted innovation model.

4.6 The interactional model of innovation and the relationship to risk

Although Schumpeter did not envisage the possible role of consultants in innovation processes, the same cannot be said of one of his contemporaries, Knight (1921) who expressed himself with great foresight in the following terms: “Recent years (...) have witnessed a veritable swarming of experts and consultants in nearly every department of industrial life. The difference from dealing in information is that these people do not stop at diagnosis; in addition they prescribe. They are equally conspicuous in the fields of business organization, accounting, the treatment of labor, the lay-out of plants, and the processing of materials; they are scientific managers of the managers of business; and though they by no
means serve business or its managers for naught, and in spite of a large amount of quackery, they probably pay their way and more on the whole in increasing the efficiency of production. Certainly they do a useful work in forcing the intelligent, critical consideration of business problems instead of a blind following of tradition or the use of guess-work methods”.

The use of consultancy services can indeed be seen as a way of benefiting from expertise and knowledge without sharing the risks inherent in producing them. The consultant-assisted model of innovation is, for the firm, a way of reducing some of the risk inherent in innovation. In this respect, consultancy shares some of the attributes of insurance.

**Conclusion**

This article has highlighted an innovation model which extends traditional Schumpeterian models. This model, in which one or more consultants (the term being used in a wide sense) assist their client in a clearly identified or emergent (i.e. non-programmed) innovation, can take numerous configurations depending on the function or functions of the firm which constitute the medium for the innovation, the stage or stages of the innovation process in question and the methods of processing and producing knowledge which are considered. The different configurations of this model depend on a number of factors including the consultant’s style, the client’s style, the nature of the problem, etc.

The standard configuration of the model, that is, to put it simply, that in which knowledge processing is limited to mechanical transfer and minimal interaction, is only an extreme case; the model is primarily evolutionary, rich in low-level or intense interaction in a range of different spaces: temporal, functional, geographical and symbolic.

In sum, the model rests on a broader definition of innovation, which takes account not only of all the heterogeneity which is often concealed behind the terms innovation and organisational change but also of the semantic diversity inherent in the various notions of product innovation - new goods, new services (intangible products), new solutions (ad hoc and tailor-made products) - and in the notion of process: technologies, methods, etc. As a potential actor in this diversity of innovation, the model is a new locus for expression of the Schumpeterian spirit of enterprise.

**Bibliography**


Boyer, R., Freyssenet, M. (forthcoming) Le monde qui a changé la machine.


