Knowledge Assisted Innovation

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KNOWLEDGE ASSISTED INNOVATION

The creation of products and/or services passes by a true partnership
connecting the creativity of the manufacturer or service provider with
the customer requirements rising from the practice from his business or a
use repeated in its particular context. The partnership is accompanied
by a mutual training like W.G. Walker describes it in a report of the
RAND CORPORATION of 1993: it consists in making go up the customer
requirements on the level of the function concerned and making proceed to
the operational level the results of the reflection operated within this
function; it is well there the role which has to play the knowledge
management seen under a dynamic angle not of collection and storage but
of circulation and exchanges, concept that one finds in the work of C.
White and T. Breton entitled "Le Lièvre et la Tortue" which
describes a reactive organization in which networks of immaterial
activities are enabled; the function in question is related generally
to design but it can be as well an administrative , commercial or
technical one from the moment at which it has effects on the appreciation
of the customer with respect to a product or a service. It should be
noted that a certain trend is observed today to induce research leaving its
pigeon-hole and to encourage the researchers to carry out training
courses with marketing to even visit the customers to study the
problems hands on . It is well what said in other words François Dalle
in "Le Sursaut" in connection with his understanding of the life of
the contractor: "One goes on the field without respite, in the stores,
with the saleswomen, one puts in contact the commercial people with the
researchers". Today, there is Internet but nothing replaces the
direct contact, it never should be forgotten.

Nevertheless, Internet makes it possible to better handle the data as
those which collects, for example, Apple which makes the most of the
requests carried out on hot-line, Levi Strauss which uses the data of
industrial measurement or Kellog which studies the requests for
dietetic information, as indicates it R. McKenna in an article of
"Harvard Business Review" of July-August 1995, entitled "Real
Time Marketing"; one can just as easily quote the manufacturers of
vehicles which provide to their dealers a data-processing assistance
with the diagnosis of breakdowns and which learn from them the lessons
necessary to the improvement of their products. The organization in
network makes it possible the various stakeholders to dialogue as early
as the stage of design of the product and even, in certain cases,
during its use, which makes it possible to design and possibly modify
the product in connection with the customer; that also makes it
possible to conceive the means of production with the operators who
will have to use them and to train these operators in connection with
the designers. The designer (or the design team) is placed in the
center of an informational device which puts him in relation with the
end-user and the manufacturing operator. That enables him to develop a
virtual product, a virtual machine (or a process of manufacturing), tools
of assistance to the training of the operators. In order to avoid any
ambiguity thereafter, let us specify that when we speak about

organization in network, we refer to as well only one company comprising various centers of profit or autonomous units as a number of distinct companies working together on a contractual basis and taking up quite precise duties, some of them being able even to exert the same function and to enter in competition, as it is the case in the market places.

Moreover, the innovation does not develop within the strict limits of a given function possibly constituting, at a given moment, a point of focusing but is diffuse through the very whole organization with the proviso of finding there a climate favorable carefully prepared and maintained by every direction and more particularly by omnipresent Human Resources Officers; the staff is then characterized, as we recommend it in our work entitled "L'entreprise délocalisée", by "his aptitude to work in team, to act and report, to get information and inform, learn and teach, listen and dialogue with his colleagues, to be able to create, maintain and develop his own network of relations". The problem consists in collecting the ideas of innovation to implement them within the adequate function, whatever their origin and that by an incremental development inspired of the "kaizan" appraised by Japanese people. According to Walker, in a report of the RAND Corporation, this joint development is at variance with the" take or leave it" attitude when a manufacturer speaks to a customer or the "show and tell"one when a foreman speaks to an operator. That can involve particular organizations; Russel L. Ackoff in "The democratic corporation" gives an example of it: in the circular organization, the decisions are made by committees not exceeding ten people including the person in charge and his collaborators and, with only one advisory vote, the direct superior of the person in charge; according to the order of the day, the committee can invite various people (suppliers, customers, expert and so on); these committees function in a democratic way insofar as the person in charge for the committee is subjected to control for the members.

Within the framework of the promotion of the innovation, by the Group Solvay , Herve Azoulay, Etienne Krieger and Guy Poullain describe, in their work "De l'entreprise traditionnelle à la start-up, les nouveaux modèles de développement", the role reserved for the "innov' acteurs" delegated by the various entities of the group in France. "... the innov' acteurs represent many trades (production, engineering departments, research, commercial, legal, human resources...), of the different hierarchical levels... ". "The innov' acteurs and their network...were the creators and the promoters of an on-line management tool on Internet of the ideas put forward in various sites."
Their activity results in transverse exchanges, work groups, the ones in order to share experiments, the others to make technological surveys and to maintain the relations with external partners. This is why one speaks about "participative innovation". According to the authors, Knowledge Management and learning organization are not able to be dissociated from innovation.

Indeed, market is not only formed by your direct customers but includes their own customers and among those various customers (or even prescriptors or consultants), you may find wholesalers,brokers, dealers, concessionaries, servicemen, contractors, subcontractors and final users, each one having his own needs and goals; among users, you may distinguish those who use your product for themselves and those who do it for somebody else; moreover, you have to take into account the context of use, namely if your product (existing or potential) is jointly used with another one.

If your product is used as a tool -a car is a tool for the motorist who uses it to go from one place to another-, you have to consider its purpose, which wants it supplies and in which way it is used. It is very difficult to speak about such a subject in a general way.

So, to design an innovation, you have to take into account the whole value chain and not only focus upon the future product itself. Frequently, the value chain shows several bifurcations; at one end of the chain, there is your company and at the other ends, there are markets (applications/customers).

This is very difficult to depict because it is generally a complex world with many clusters. The best way to be computer-assisted seems to use K-Maps. One interest of them is the possibility of anticipating future realizations even if they do not yet exist and they facilitate metaphoric thinking. Do you think that the scientist who discovered Laser-effect was able to forecast such different applications of it such as DVD, bar-code reading, fine metal punching, cloth cut or eye care?

In consequence, if it is not sufficient to investigate the world of designers and users (company and markets -in the plural-), it will be necessary to associate to them representatives of the research community. I know it is a hard task because speculative searchers are not always interested in practical problems; so you must find out some open-minded scientists or facilitators. This scientific quest is important because there are latent needs which are never uttered for want of imaginable solution. Moreover, you will have an uninterrupted coming and going between laboratories and markets because an application in a given field may sometimes be transposed into an application in another field after it has been re-thought by the scientists.

Thus, let us say that there is a connection between "new knowledge" -coming from the laboratory- and "human capital".

The role of the innovator is to coordonate the different actors via a network, a portal and collaborative platforms; his dashboard could be a collection of K-Maps.

To the question "Who innovates? The Company or the Market?", it is possible to answer:
- The company (unless the innovation is subcontracted)
- The markets (in the plural)
- The laboratory (at the origin of the discovery, if not inside the company)
- The ... innovator (for he has a specific role).

If your Company wants to innovate in order to remain competitive, it must start from a knowledge base. This base may be internal or external; it generally depends on the degree of theoretical content and the nature of knowledge –whether it is codified or tacit-. Scientific knowledge is more often codified whereas engineering one is rather tacit when it lies on know-how and experience.

If sometimes innovation results from a sudden insight (penicillin discovery, Post-it ® first idea...), such cases are more and more seldom; innovation has to be embedded into a genuine strategic plan taking into account the specificity of the product to be brought to the market. If you look at the 2006 Report (1) of AUTM ®, you will learn that only during 2005, 4932 new licenses were signed between american universities and companies and 527 new products introduced into the market as a result of applications of fundamental research such as a nano-printing press based on nanometer-scale technology of materals and processes as an alternative to expensive optical lithography tools or a process based on surface charges properties applied to coagulation-filtration for removing heavy metals from drinking water. Indeed thre are many examples of scientific discoveries having led to new technology-based products such as "Lucent Tecchnologies' Bell Laboratories fundamental studies of non linear optical processes [which) led to the invention of optical fibers engineered for greatly reduced chromatic dispersion" (2). Thus, an innovation state-of-mind has to start from theoretical research and extend to business concerns (manufacturing at low cost, marketing and distribution channels), the last stages allowing a return on the investment incurred by the first stages Only an holistic attitude may ensure a regular flow of innovating products to a firm so that you have to imagine a pipe-line with an input of basic research and an output of new products (and corresponding profits). We insist upon the fact that the chain must be complete because without serious theoretical basis you may lack of means to succeed in delivering a satisfying product and without caring for commercialization you may go beside return on your investment and spent time.

It is true that you need basic research even for very popular products. You will find a good example in the "American Competitive Initiative" booklet (3) which shows how MP3 devices are indebted to
. thin-film metallic multilayers which led to magnetoresistive effect used in micro hard drive storage
. electrochemistry which gave rise to lithium-ion batteries
. liquid crystal which opened the way to transistor LCD display
. fast Fourier transform allowing signal compression.
The main issue is how to access to the knowledge which generally originates from research institutions. Karan J. Sorensen (4) distinguishes
. absorptive capacity (in-house basic research, publications, patents, conferences, exhibitions and so on)
. connectedness (direct exchanges through meetings, networks, CoPs, reciprocal visits, research consortia and so on)
. collaborative research which we shall examine further.
Whatever method you use, Knowledge Management is a must to share the

information and any how, as Sorensen underlines it, it is very important to identify the "Thought leaders" in your own field.

Collaborative research is at the source of the main successful innovations and some firms designed very efficient methods as CISCO, in the frame of its "Emergent Technologies" with its internal entrepreneurship-minded start-up teams with external assigned persons or DEGUSSA with its "Project Houses". One of them was described by Dr Andreas Gutsch, Head of Creavis Technologies & Innovation, Degussa A.G., for "NanoTech Day" on September 28, 2006. The problem encountered was the excessive heating of new batteries for hybrid cars; it was solved by a ceramic separator based on customized nanomaterials designed thanks to a platform working in collaboration with academic institutions during 3 years under the same roof, gathering academic scientists for their fundamental knowledge together with Degussa searcher for their technology experience and marketing knowledge. Let us observe that the market amounts to € 1,4 billions and will reach 3,9 in 2015. Such an initiative was well detailed at DECHEMA in Francfort ion May 29, 2006 (5).
Project Houses are new technologies platforms staffed by a 20-30 persons teeam with a budget exceeding € 15 millions and doomed to last 3 years, with a close cooperation with academia, the products or processes sprung from their research being commercialized within existing Business Units or through internal start-ups.
As you may see, innovation is no longer left to chance but it relies on long term project management leaning on a few selected domains: it implies a structuration with ad hoc commitees, regular meetings with agenda, visits of sites and so on. An important issue is the status of IP when several entities work together; this supposes that contractual relationships regarding the result of the research have been clearly defined (6) namely who will own the patent or benefit from its commercialization or industrialization, that communication between the members is guaranteed and that non-disclosure to third parties is required; the royalties if any have to be specified.

What is called the Fuzzy Front-End (FFE) by authors as Petre Koen (7) is the stage lying at the very beginning of the innovation process ; this process is generally considered as a funnel starting with ideas, followed by a development stage, a prototype stage if any, manufacturing and commercializatio; each stage is separated from the preceding one by a screening in order to select valuable possibilities and take into account potential constraints. Whereas the innovating process has been thoroughly studied, the FFE is an ill-known creative process because it is quite unstructured and especially iterative though it is the most critical phase that the future actions depends on. To identify business opportunities, you have to know both the research capabilities and the customers needs but this is far from being explicit knowledge.

Indeed, the starting point itself is unsettled: you may start from the current research, external or internal, or from the market needs and the environment trends; you may expect an incremental innovation or a radical one; this stage may be limited to an individual without any

instruction or extend to a team made up to fulfill a project.
To our opinion, radical innovations are more research generated and
incremental ones more customer-generated though they are both for
customer's sake. In fact, the quite initial concept begins to grow
inside the heads of individuals and this is a permanent phenomenon.
For this kind of individuals, the main purpose is being acquainted
with scientific, technical and social events even if they have, as it
generally is the case, a function in the company of Marketing or
Strategy Executive Officer.

In practice, innovation begins mostly with a hint which will bootstrap
the whole process until its closing or before in case its unworthiness
should be recognized. Such a hint is not yet the "idea" referred to in
some theoretical models (8) and is situated upstream: it is just an
intuition according to which such or such field of basic research
could be useful to the company in order to respond a need, either this
need is explicitly uttered by customer or just latent (it is latent
when users are only potential because people did not yet thought of it
but would welcome the mean to satisfy it if it would be offered to
them). From this moment, a sequence of actions has to be impulsed in
an iterative way:
- study of scientific and technical literature
- identification of related patents and competition actions
- contacts with searchers and experts
- market investigations
- meetings with laboratories representatives in expectation of
contractual relationships
- discussions with customers to collect their suggestions or imagine
their point of view
- statement of principles
If the innovation concerns a product made of several innovative
components, the same steps have to be taken for each one after
breakdown of the whole as in the case of MP3 quoted in the precedent
comment.
We did not allude to potential constraints about supplying,
manufacturing, distributing and so on which are entered upon during
the innovation process itself and which available models take into
account.
Various technologies may be used to help working up such processes
located at the advanced posts of innovation: Knowledge Management and
Business Intelligence for information gathering and methods of
customers needs deepening such as "virtual future environment"(9).

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*(1) FY 2005 AUTM ® (Association of University Technology Managers)
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