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THE ORGANISATION OF AN INNOVATION PROJECT ASSISTED BY A CREATIVITY MODEL

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1. Introduction

This article aims at offering a model able to define the role of the positioning of innovation and creativity in the conception process of a product. Firms confronted with a complex and competitive market [Groff et al., 2003] have to innovate constantly in order to adapt their products according to new contexts and to customer's expectations. This obligation to innovate makes you wonder how to implement creativity and therefore the methods leading to it while taking advantage of the knowledge and capabilities of the company and thus take advantage of the internal wealth. To give a first approach, this article will start with an insight on the methods and definitions already existing in creativity to end with the hypothesis of the construction of a model. A second part will deal with the methodology of conception and validation of a model. Then the main part of the article will present the model and the actions that allowed to validate and complete it. The conclusion will show the implementing perspectives which balance and aggregate the visions of conception and creativity.

2. Problem: creativity faced with a complex environment

2.1 Context

For a few decades, companies have been creating and undergoing the deep transformations of their socio-economic environment. The structuring parameters of these developments are – among others according to Morin [Morin, 1992] – linked to the technological renewals, the characteristics of the final demand and the international dimension of work and markets. This new environment is characterised by a high level of uncertainty as far as the effective expectations of the market, the available technologies and the ability to master the environment system analyses are concerned, and it gives an increasing role to mastering information and knowledge on the economic activity.
Against its ever changing system of working references, a company has to define a strategy enabling itself to maintain or even increase its shares of the market. From then on two opportunities seem to emerge. Either the company takes the drastic decisions needed to reduce the cost price of the products and services it supplies, or it chooses to have a strategy of differentiation based on innovation. As Romon showed it [Romon, 2003] this dichotomy is a caricature. The companies we worked with are situated in a continuum in between those two extremes. Their strategies of differentiation are based on the organisation of their conception, innovation and creativity processes, taking into account the material, financial and intellectual means as well as the immaterial capital it has got.

2.2 Theories on creativity and its associated processes

Together with Forrester [Forrester, 2000], we think that the creativity applied to products takes part in the emergence of innovation. As a matter of fact a company is not able to recognise the processes to

be implemented in order to stimulate that search. The theoretical study of this domain shows that creativity is a "hidden" act (in the sense that it cannot be totally modelled) of production of ideas based on an uncertain mental process of acquisition and information combination [Demory, 1976] [Moles et Caude, 1970]. Our analysis has brought us to set out the hypothesis that creativity could be stimulated by a particular form of knowledge accumulation which – as we have moreover emphasized – is part of a company's strategy to take good advantage of what it has got.
In spite of appearances this question is far from being basic, it bears a common dilemma between keeping up one's assets and innovating. In other words : is the capitalization of experience a brake or a contribution to creativity ?
To corroborate this hypothesis, we tried to answer the question : what kind of a creativity model can support a relation between capitalisation and creativity?
To answer that question, we have studied and discussed the creativity models suggested by different researchers [Wallas, 1926], [Perkins, 1981], [Rossman, 1931], [Osborn, 1953],[Koberg et Bagnall, 1981], [Isaken et Treffllinger, 1985], [Baron, 1988], [Fritz, 1991], [Parnes, 1992], [Plsek, 1997], [Bouchard, 2001], then we have modelled a type of creativity meant for operation units [Rouquette, 1997].

3. Method

Our work to elaborate a model is divided into three stages :

- Introduction from a stamping ground
- Validation made by professionals
- Comparisons and validation made by engineering students meant to become professionals

A first model (M1) was initiated from a qualitative study of the creativity processes of the R&I service of a first rank car parts manufacturer well known for its abilities to innovate and to implement its knowledge and technical assets. We interviewed the emblematic actors (9 people) of this service.
We modelled a knowledge that had never been before and then we tested the model M1 comparing it to the practises of 2 different populations (manufacturers and engineering students).
We showed this model to creativity "referents" thanks to a protocol made of semi-directive questions :

- The actors of the R&I service in Plastic Omnium previously approached
- 3 teachers and researchers as well as designers working on the domain of creativity at the University of Technology in Compiègne
- 2 creativity leaders from the Innovation and Creativity Pole in PSA
- 3 creativity "promoters" from the Amont Project Management in Renault SA

The results of this validation allowed us to suggest an evolution in the model (M1) that we then compared to the approaches developed by the engineering students to answer a problem of industrial creativity. Each semester since 2001, we have questioned classes of 30 to 50 students, that is to say about 240 students. This study is made in groups of 5 or 6 students. We consider that each class of students composes a homogeneous sample, marked by new and updated knowledge and little professional experience but on the other hand having a very "engineer-like" approach which is rational and determinist. The students are by a majority (87 to 100 %) ending their degree course (school leaving certificate + 5 years at university). They have already spent at least six months in a row as trainees in a French or a foreign company. Each student is given the wording of the exercise. No particular information is given. If any complementary information turns out to be necessary , it is given verbally to the whole class. The exercises are not taken into account in the marking needed to pass the credit, therefore there is no strong pressure. In each group there is an observer – a neutral element – who writes down the process that was set up and compares it to the model we propose. The model allows us to analyse the students' intuitive approach to creativity.

3.1 Presentation of the model

The qualitative study as well as the literature on the domain show that creativity is an approach controlled by several parameters. The models of creativity approach described by numerous

researchers don't express clearly this relation of uncertain variability of the creativity actor. We have built a model meant to represent more precisely that matter of fact.
The model we propose has been set up thanks to an affinity diagram [Jiro, 1991]. Through grouping meta-actions, we synthesized the results of the qualitative study, the experimental studies run with engineering students and the analysis of the aids to creativity. Those three interdependent meta-actions (understanding, explaining, conceiving) correspond to the three first stages of Vadcard's positioning chart of the aids to creativity [Vadcard, 1996]. Then we refined the analysis subdividing the meta-actions into action verbs. Each action verb represents an operation to be made within the context of a creativity approach. We go from a generic level to reach, if necessary, a specific level.
The model we propose is different from the models listed previously in various ways. For a start, in our own eyes it offers an uncertain interaction that may be sequential or simultaneous between the different specified actions. The model formalises three poles usually present but often implicit : analysing, generating, explaining.
Analysing is the task most frequently taught in engineering schools and it results from a rational approach. It is meant to give all the elements of reflection that are supposed to play a part in creativity itself and in the evaluation of the result.
Generating is a stage that has long been left to the spirit of creativity or considered as a black box, it has only been structured recently. Passing from analysing (that is the elements) to creation is far less studied because it lays on the hypothesis that analysing is a standard action that produces a proper translation of the elements adapted to creation. This leads us to the explaining pole which applies as much to the translation of analysis into exploitable elements for creativity as to the explanation of the results of creativity in order to examine it closely according to the criteria of analysing.
Then it does not impose any starting point. The creativity process can be initialised in any action of the model.
Finally, unlike the models issued from the theoretical corpus, we don't suggest any "incubating" or "illuminating" stage. Those ones are formalised with the interaction arrows which represent the iterations of confrontation and adjustments of ideas, hypothesis, reasoning, exchange and knowledge. They carry the illuminations' "big bang".

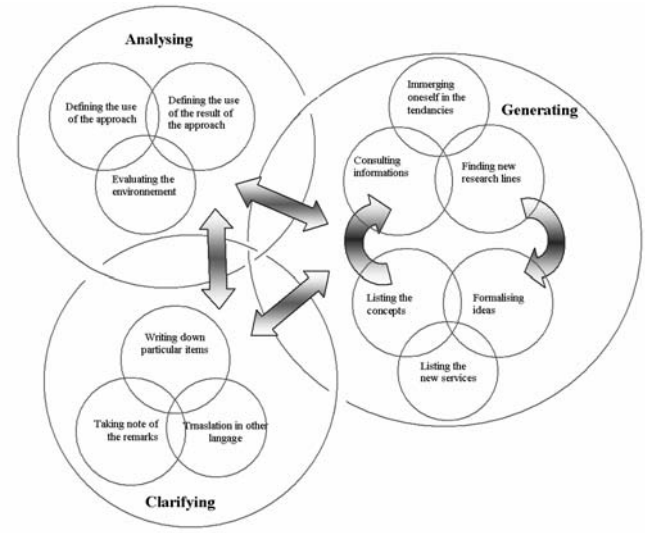

Figure 1. Model M1' – The fractal clover

4. Experimental results

To begin with we tested the validity of our model comparing it to a creativity approach applied to an architectural project of the Renaissance period. We tried to assess if our model could be applied to a

domain (such as creativity in the conception of industrial processes in manufactures) which is less restrictive than our research ground.

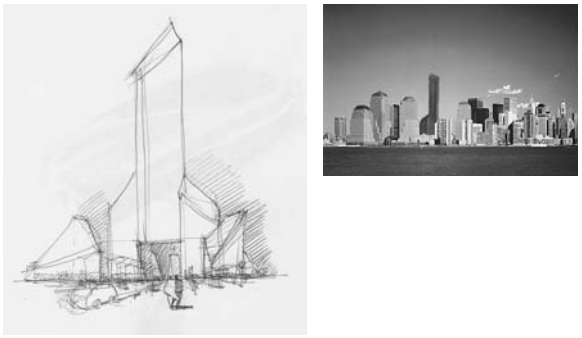

Figure 2. Architectural project

A team formed of a French sculptor, a Romanian architect, an American architect and a teacher from the University of Technology of Compiègne, suggested an architectural concept to rebuild the World Trade Centre. This study, that we have examined within the scope of this action research, took place on a short period (1.5 months). To carry this analysis through to a successful conclusion, we defined several points to examine. At the same time, we noted down the different working stages of the group, the type of information used (conceptual/parameterised iconic form) and the methods and tools used. Each working stage that was carried on has been compared to the model in order to establish if it was matching it or not.

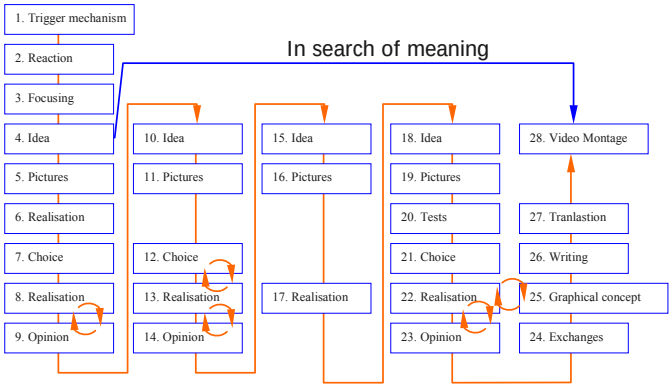

Figure 3. Organization chart of the architectural project

The results of the experiment show that the model is generic enough to allow a description of the creativity process used. We connected each stage of the process introduced above with either a meta-action of model M1 or with one or several actions building up a meta-action. Moreover we have been able to link each action to the tools and types of information mobilized during a creativity approach. This statement could corroborate a study carried on a creativity project in the aviation field [Alberti & al., 2003] which brought out the fact that the presentation format of information has to adjust as much to the specificity of the actors of the team (competences, abilities, know-how, inter-personal skills) as to the type of product made.

Then we took down the interaction between actions and meta-actions. Actually, the creativity process goes back and forward at random between the different components of the model. Finally we noticed that the actors in the creativity group focused longer on the “GENERATING” meta-action.

In order to sharpen the previous results we realised a new study which took place during a week-long training period in innovation made at the University of Cluj-Napoca in Romania. After attending a

twenty-hour-theory course, the working group composed of Romanian teachers (PhD and engineers) questioned the relationship between the pedestrian mobility and the car floss in a heavy urban environment. On that basis, the working group had to realise a work process aiming at generating an innovation matching the previously described systems.

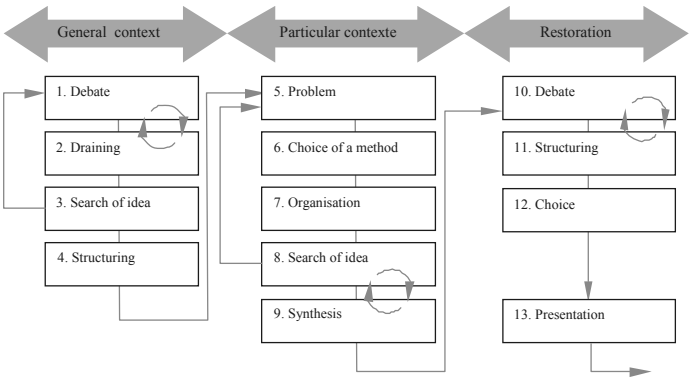

Figure 4. Organization chart of the Romanian project

The second comparison corroborates the results of the first one, showing that our model allows to describe various creativity processes. Moreover it offers complementary information on the fractal clover's contribution. During the observation stage we noticed that the group was divided into two sub-entities which were implicitly assuming tasks that could be correlated to one of the three meta-actions of the model. Each entity can be characterised by two objective parameters which are the age and the cognitive abilities at using computing means.

We have not interpreted the second parameter but on the other hand we suggest to analyse the first one, that is the age. We could see that entity A (3 people – age bracket : 49-55 years old) had a more important activity within the "ANALYSING" meta-action. Its approach based on very pragmatic remarks linked to a context that is reduced if not reducing suggests a way of thinking that is rational and precise. Entity A has gone from a "participative equal" process to a "participative follower" process as fast as the project went along and as the intensity with which the context was thrown back into question. The impact coming from the work of entity B (5 people – age bracket : 25-35 years old) intensified from stage 3 to change into a leader's process. Among this entity 2 people have emphasized their activities in the following actions : consulting information, becoming imbued with the tendencies, finding new research main lines. They worked on researching graphics data (pictures) enabling brainstorming. The other part of entity B directed its activity towards the "ANALYSING" and "EXPLAINING" meta-actions. Then entity B as a whole assisted by entity A carried out the following actions : registering new concepts, writing down new services, formalising ideas.

To understand better what was the importance of age as a discriminate criteria, one has to remember that Romania has been under a dictatorship for about 40 years. During those years (1947-1989) the industrial development has stagnated as much on the technological point of view as on the methods and processes implemented. The conception leitmotiv was to offer the expected answer to a purpose that had been imposed and defined by the hierarchy of the firm. Entity A kept a cognitive approach that was very much stamped with that lack of freedom of thought. As far as entity B is concerned, it was more open to a progressive approach increasing the standing of a combination of ideas to the detriment of a unique thought. It is interesting to see that the assignment of the tasks corresponding to the actions listed by the model was made implicitly according to the abilities of the opposing actors. Moreover a temporal analysis of the creativity process shows that the team spent 65% of its time analysing and building the problem it had to solve.

To complete that stage it has used by 80% the written and oral language to convey factual, tangible and technical criteria.

We think that the results that were achieved at the end of the creativity process are very pragmatic and technical and can be applied on a short term basis.

5. Debate

In our own eyes, the creativity model we offer is attractive for several reasons.
First of all it is a descriptive and founding formalization of a creativity process. Indeed this setting allows us to objectively recount the progress of a creativity process. Thanks to that model we can see the iterations implemented between different actions, the iterations in between the meta-actions, the knowledge, the format of the knowledge linked to the actions, the actors thrown in and judge the weight that each pole has taken in the creativity process. We consider that under its descriptive form the model allows us to correlate the abilities and competences available within a company whose creativity processes have been displayed within this structure. In fact it is likely to answer the predicted dilemma : being creative and innovating while taking advantage of the company's assets at the same time. Thanks to a prescriptible approach we could build a system of reference of the abilities linked to the model, which would allow to develop creativity teams fitting particular objectives. In the same way we could correlate tools or methods to the different actions listed in the model.
Then we noticed that the time the actors have passed in activating the different actions could distinguish the achieved results. We contemplate using this model in a typological piloting of creativity, that is to say orientating the creativity process according to an objective of breaking answer or an objective of incremented answer.
Finally, unlike the models following Wallas', our model allows to contemplate an instrumentation for each action while staying representative of the heuristic creativity process.

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