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# CREATIVITY AND INNOVATION PROCESSES

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## Abstract

Companies are eager to provide innovative products due to the current economic pressure which is in part due to globalisation. Current technological innovations tend to introduce a larger immaterial part into new products as the rates of return expected by investors become shorter and scale effects are expected. In terms of immaterial products in computer sciences two categories of groups are able to respond with adequate innovation levels. These two groups are large international corporations and freelance designers who create networks over which to communicate and share information. Yet the fundamental difference between creativity and innovation can lead to a conflict of interest between them, the designers and innovative companies. A conflict has already started opposing the two groups. Large corporations have a tendency to lobby parliamentarians to favour their interests and to bring to court some innovative uses of new technologies. Some users fight against this by proving to be very creative and inventing further solutions avoid the restrictions and by forming and joining user defence associations. It can be said that by maintaining a high level of diversity and a freedom of creativity the benefits would be seen by all parties. If one looks at the long term effects of products, it is plausible to believe that the economic weight of the products created by freelance designers, who do not think of innovation in its industrial form, is more important than that of innovative products which are created by the oligopolies that control most of the markets. The discussion closes on proposals for the creation of legal and exchange structures for isolated designers or networks which would help create links between the designers and users or economic links via innovative companies.

## Introduction

This paper deals with the relationship between a creative and an innovative process for industrial products, with a specific study of mecatronic systems. In today's global society dominated by free trade of products and services, one of the most important economic drivers is the introduction of new products "wanted by customers" on the market. Customers are attracted by novelties; this increases their estimated value which in turn increases the exchanges

when their estimated value surpasses their price. Investors tend to seek financial growth by multiplying their assets and companies must find the means of increasing their profits. To increase those profits, it's possible to increase product sales by stimulating demand by providing new products. Consequently, this is commonly believed to be one of the drivers of the economical success of a company and therefore of the financial success of the investment [CAM 04]. This can lead to a conflict of interests between the creative process, an activity which is highly difficult to control and quantify because it requires freedom of thought and a leniency in the work schedule, and the innovation process which is often associated with a rational and quantifiable work production [OSL 92].

## Creativity

Creativity can be defined as the ability to create something new, to innovate. Creativity can be found in all fields of human activity: arts, sciences, technical solutions, etc. It is an activity where the mental works involved cannot be easily measured in terms of work hours spent at the office, bank, workshop or factory. Designers tend to produce quality work when they are surrounded by other designers which are not necessarily from the same field but they may also feel the need to isolate themselves in order to get things done. Detailed biographies have been written about great designers, these helped study their thinking and work processes. Every creation or design is based on a transgression of widely accepted rules or conventions. This allows the designer to overcome a contradiction or to make something happen which appears to be impossible, for example creating a flying vehicle which « weighs more than air ».

## The creative process in the field of industrial products

Several methods exist which help stimulate the creative output in the industry and such fields as advertisement. These methods include brainstorming [OSB 59], the six-hat method [BON 93], etc. They are supposed to encourage the session participants lose their inhibitions and transgress conventional rules. The methods provide guidelines which help introduce novelties into a technical solution or an industrial product. In a way they transform the creative process into an innovation process. These methods are

developed by analysing the underlying intellectual processes of designers but they cannot provide a means of stimulating the creation of new ideas. They do not take into account the fact that the creation of new ideas has a human dimension and therefore does not only have a rational side but can also be created due to an emotional state, by accident, inconsistently, etc. The basis for a large number of creative ideas is a transgression of a widely accepted standard or rule. The designer frees his creativity by overcoming an intellectual barrier. This transgression is not taken into account in the TRIZ method which includes the 40 principles, the 39 parameters and the contradiction matrix [ALT 85] even though the method's goal is to show the contradictions one must overcome by getting around the problem, using inversions or deleting parts. One also cannot always obtain unrestrained creativity while participating in a group activity such as brainstorming as it follows a pre-established pattern which can inhibit creative thinking.

### **Innovation**

To innovate one needs to introduce something new to an existing technique, structure or product. The Oslo manual [OSL 92] defines the technological product/process (TPP) innovation as a discovery or invention which can be spread widely either through production on an industrial scale of an innovative product or through massive introduction of innovative services or methods. The report of the Attali commission for the liberation of economic growth contains propositions which favour innovation and recommend a change in the French higher educational and research systems. The change should prepare the systems for an economy based on knowledge whose goal would be to provide innovation. (perpetual progress? [GOL 84]). Genrich Altshuller and his team analysed numerous patents, using the results they have elaborated the TRIZ method which helps stimulate and give direction to innovations.

### **Creativity/innovation paradox**

The paradox is due to the fact that designers would prefer not to take into account, while working on a project, such constraints as production costs, limited availability of raw material for a restrained market, difficulties linked to future after-sale services, up to the ability to invest in the production tools. Indeed, creativity is based on the transgression of rules, it makes it possible to drive without seeing, take pictures at night, see without being seen, hear without being heard, wash without using water, be dressed without wearing clothes, take off vertically. The designer only has the final result in mind, the means of coming to that result are not important. A search for the word « creativity » in the Oslo manual [OSL 92], the Camdessus report [CAM 04] and the Attali report [ATT 08] gives the following results: 0 uses in the Oslo manual, 4 in the Camdessus report and 7 for the Attali report whereas the word “innovation” appears 28 times in that same report, 47 times in the Camdessus report and 1055 times in the Oslo manual! How can a manual dealing with the measure of scientific and technical activities, which mentions in detail the TPP innovation, not mention the word “creativity” at one point? Perhaps this is because the constraints imposed

by the economic world which are necessarily taken into account in an innovation process and they can oppose go against creativity. To paraphrase the paradox mentioned by Robert M. Solow [SOL 87], it is possible to say that “creativity can be found everywhere except in official reports on innovation and growth”. Out of the forty principles used in the TRIZ method, at least eleven deal directly with materials, some others with production, maintenance and costs of use. If one follows the principles closely, it is possible that creative solutions will be overlooked as the thinking process will be mainly aimed at taking care of the contradictions pointed out by the method. The final decision makers' caution will then go against the more daring propositions made by the designers. For this reason a conflict of interests can appear between the designers and the innovative companies. This conflict of interests can potentially destroy any good relationships between the two groups, the professionals working at the innovative companies rejecting designers, the craftsmen and industrials eliminating artists. This has already been seen multiple times throughout the years. For example the emperor Tiberius ordered the execution around 30AD of a man who had offered him a container most likely made of aluminium; Denis Papin saw his boat, which used a steam engine, destroyed by the dock workers of Weser in September 1707 while he was cruising the river in the hopes of reaching England; Barthelemy Thimonnier should be mentioned too as the first sewing machine he produced were destroyed by the Parisian tailors on the 20<sup>th</sup> of January 1831.

In more recent years, it has been proved that sometimes the best solutions do not necessarily take over a market. For example quartz watches which use high polluting batteries greatly rule the market even though mechanical watches provided satisfying results and were 100% recyclable. Moreover, the battle between the different video recording on magnetic tapes systems (VHS, BétaMax, V2000, VCR, and SVR) is also interesting. VHS tapes held the entire market between 1975 and 1985 even though they were neither the cheapest nor the best. Innovative companies place the market at the centre of their considerations and make their major goal the perpetual stocking of that market with new products. This brings them to make choices which bring profits on the short term but those are not the choices the market would have required had the consumers and designers worked together directly without the intervention of an intermediate innovative company.

### **Consequences of the creativity/innovation paradox**

The first consequence is that if the innovations have follow a fast rhythm, i.e. new products have to be rapidly introduced on a large scale, the novelty items should not require a large change in terms of quantity of materials used nor a total change of how the product is used. Therefore most innovations today are made up of additions of new immaterial parts which require light electronic components. The objects to which these additions are made are then advertised as having greatly improved performances thanks to the new parts. Moreover the margin of progress of estimated value is rather important mainly due to the infinity of combinations of new services and uses provided by the flexibility of software and the fact that

progress in the field of microelectronics doubles processor capabilities every 18 months. These aspects have not gone unnoticed by reports on economic growth. As a consequence, the most innovative fields have been those of operation systems and software, video games (zero mass), watches, calculators, mobile phones, photo and video cameras, MP3 players, GPS modules, PDAs (light mass), general public computer hardware, computers, television sets, video recorders, music systems, etc. These are not the only fields which are touched by innovation, every part from the household to an airplane, not forgetting large building, bridges, automatic doors, can be fitted with a portable system and participate in the inevitable incremental innovation which seems to be immortal... or at least immortal up until the day when buyers and users/consumers will tire of it. A new approach to innovation is through the addition of new molecules, nanomaterials, microfibers, GMOs, etc. in innovative products. The potential health hazards act as brakes or retardants in these cases [REA 06]. To fight this, innovations take other shapes, for example the reduction of the environmental impact, ergonomic aspects, increase of aesthetic properties, introduction of more economical products by minimizing the loss of value, longer guarantee periods, recycling, multi-use, reusable packaging, edible packaging, renting rather than selling, etc. A reading of Eliyahu M. Goldratt's book *The Goal* [GOL 84], more precisely a reading of the epilogue where the author shares his own story, shows that a great talented character had to abandon applied sciences then products then the development and sale of professional software to finally end up training and developing games simulating a company work environment.

His story shows that the longing for innovation will push the economy first towards a dematerialisation of services then of products, in order to accelerate exchanges, before the limits are reached. These limits are those of buyers to accept perpetual changes and those, quite troublesome, of the resources found on the planet Earth. This, apparently endless as seen by those who believe in economic growth due to innovations, incremental innovation goes against all the technologically oriented dreams of the second half of the 19<sup>th</sup> century and the first years of the 20<sup>th</sup> where the sole goal was to provide a better lifestyle. Oligopolistic companies prefer to turn their human creativity resources towards their innovation process which help increase their profits by perpetually flooding markets with new products. A consequence of this might be the crippling of imaginations, the inhibition of chance or irrational thoughts and discoveries, inventions which could have helped humanity could never see the light of day. Currently many European countries prefer to make drastic changes to the structure and management of research organisms, mainly public structures. These projects are backed up by the fact that politicians want to direct research towards innovations which could benefit economic growth. Yet certain practices do not help TPP innovation like for example the creation of laws to protect intellectual property [JO 06] of designers who do not follow the innovation process but are still rather inventive or the creation of taxes on blank computer storage units to make users pay for the lost revenues from copyrights but still sue those same users for having burnt copyrighted

material. Still, there is hope in the long trail model [AND 07] which appeared in 2004 and which allows one to imagine a complimentary or even a symbiotic coexistence between creativity and TPP innovation. The model is based on the observation that a majority of products are only aimed at a minority of buyers. The large chain stores prefer to fill their aisle with the minority of products aimed at the majority of buyers such as food, clothes, detergents, hygienic products, etc. But that minority of products which can interest the majority of buyers does not constitute, by a long run, the entire economic exchange scene. Indeed, multiple cases have proved that the sales of products with limited distribution can cumulate to provide larger revenues than those of common goods. It is possible to hypothesise that the same can be said about creative products, a minority of those can be applied on a large scale and therefore corresponds to TPP innovations. The majority of creations do not correspond to this definition of innovation but they should not be ignored by the distribution network and should be protected on a legal scale.

### **Social consequences**

The creativity/innovation paradox could have harmful consequences such as the mental sterilisation due to the sacrifice of radically novel ideas for the sake of internal product growth. In order to avoid such results, a system should put into place which would help designers who prefer to keep their creative freedom and diffuse their own work and new companies which want to distribute products that do not necessarily correspond to conventional profit-making criteria in the scope of innovations that contribute to economic growth. As innovative products are made up of increasingly large immaterial parts, the socio-economic structure able to provide a fast enough output with today's large scale innovation distribution are getting scarce. The economy of immaterial goods requires large quantities of human work hours and two main providers of novelties are starting to form. On the one hand there are giant companies which progressively buy up innovative newcomers to the market which do not have the resources to get to a threshold where they would be able to keep growing freely and on the other hand there are free organizations which help unite the creative output of different individuals, they use communication networks to share the intellectual and artistic creations they make during their leisure time. Careful observation of recent events in the fields of operation systems, portable systems and such products as netbooks yield to the conclusion that large companies are losing ground to groups of freelance developers as they have a bigger inertia and they have trouble coordinating the work of a large number of people working on a changing goal. Looking at history teaches us that it's neither the largest armies nor the ones with the best equipment which win the battles and wars. Globalisation can be compared to an economic and financial war which should be overseen by the WTO rules [WTO 08]. Financial interests start fusion-acquisitions which lead to oligopolies that control whole markets and pseudo-competition or to monopolies and therefore to unlawful domination. Yet the market growth and the fast pace of innovation desynchronise the different branches of large corporations created after fusions and acquisitions and they are therefore slowed

down compared to smaller and lighter organizations. In the field of immaterial goods this can be seen in sudden events with spectacular endings such as the disappearance of software editors Ashton Tate, Digital Research, etc. The smaller structures will most likely spread from the immaterial world to that of product and service exchanges but on a LES (local exchange system) model. They could also enter the world of object production using as a stepping stone the sale and distribution of objects which are not profitable for profit seeking organizations. The new information and communication technologies (ICT) should lead to the emergence of GES (global exchange systems) whose exchange unit has yet to be defined as an octet or joule or any other exchange unit of the immaterial and non-monetary kind. The battle between the two types of structures, giant corporations and freelance groups, is happening in many fields. The most important one is legal, for example the intellectual creation protection laws [JO 06] are being changed or are being created. Leisure time of working persons is also diminished by an ever increasing work week and working years. Amateur freelance designers are also forced to join profit-seeking organisation by either, in the best case scenario, job offers for the best contributors (transforming them from amateurs to professionals) or, in the worst case scenario, by suing them for unlawful competition with the sole goal of destroying them (transforming them from amateurs to outlaws)! Yet freelance creations in the field of arts and literature leads to novelties which can find a market more easily than the creations backed up by the major corporations in those sectors. It appears that as a consequence, the field of freelance creations needs to be maintained and developed for new products and it needs freedom to accept innovative contributions outside of those offered by oligopolies which have a tendency to come between the markets and designers. The ICT offer ways of putting directly in relation the designers and users for innovative products beyond the industrially produced innovative products. There is therefore a need for a legal structure recognised by tax systems which would protect and help the freelance designers' groups. A further legal structure would be needed to extend the rights linked to general public licenses. Very few artists and software developers offer websites which offer both a showcase of their works and their sale. A few open source projects which contribute to the knowledge economy have a donation page which helps run the websites [WIK 08]. The donation system could be further developed, especially in the field of research. Perhaps work could be done on a system which would offer the possibility to help, through personal donations, a person or group working on a very specific project. Such a system could even lead to partially tax-free donations.

## Conclusion

The authors have given their subjective point of view on the antagonism between creativity and innovation TPP and their proposed solution is to reinforce the direct link between the designers and users by creating exchange

networks based on Internet technologies. This could create a GES (global exchange system) which would not use a monetary exchange unit but an immaterial unit either dimensionless like an octet or with a dimension such as a joule. The exchange unit would be linked to a market which uses monetary exchange units. The GES could only be created if the legal body provides laws equally protecting the interests of the different parties involved and by regulating the transfers of non commercial exchanges towards a WTO regulated space. Two networks can be already be found which follow this idea of coupling in one space non-commercial and commercial activities: online game platforms where players can earn virtual money resell them to other players and the online open source development system sourceforge.net. A network in the shape of a GES would provide innovative companies with a source of ideas which they could take and filter using such methods as TRIZ.

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