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TRUST AND TECHNOLOGY: TWO DIMENSIONS TO OPEN AND AGILE INNOVATION APPLIED TO THE CONSUMER ENERGY MARKET

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ABSTRACT

Open Innovation is widely explored, and many technologies are developed to support the involvement of stakeholders in its distributed co-creation process, i.e. when actors work asynchronously and at geographical distance. One of the fundamental parameters to the success of distributed collaborative approaches is the trust that the actors have in each other, in the current process and in technology. However, practitioners make little use of trust as a parameter for piloting and supporting co-creation project deployment. The lack of understanding of the mechanisms involved seems to explain this situation. Using the analysis of two case studies of co-creation in the field of energy, this paper proposes to identify the levers, notably technological ones, favouring the trust between stakeholders and by extension the agility of the process. In addition to practical lighting, this paper provides a first co-creation project management framework for practitioners, through the design of the "Co-coon Matrix".

KEYWORDS. Trust, Open Innovation, Agile Innovation, Living Lab, Co-creative platform.

JEL Codes: O31, O33, L17

INTRODUCTION - THE CHALLENGE OF OPEN AND AGILE INNOVATION

Chesbrough (Chesbrough, 2003) introduced and defined the concept of Open Innovation (OI): "Open *Innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well.*" This concept and its related practices are now widespread in the socio-economic world. In this context, the challenge is no longer to disseminate the OI as to identify the levers to strengthen it, relying in particular on the areas linked to this flagship concept. Among the development axes of the OI, we can mention in particular user-driven innovation that we will address through Living Labs (LL) (Folstad, 2008) and Agile Innovation (AI). Although popularized by the notion of agility in the IT field (Highsmith and Fowler, 2001), AI is available at different scales, from the small team within a company to complete organizations, whether industrial or public. For example, (Dikert, Paasivaara and Lassenius, 2016) study in particular agile transformations at the level of large industrial scales. (Mergel, 2016) focuses its work on governments.

Within an organization, Agile Innovation underlies a twofold process of openness. The first level of openness concerns project teams in the upstream phase of innovation, whose members are expected to interact regularly with the end customer, or even the user of the product or service that is in the design stage. In addition, the organization itself must be part of an open innovation process requiring interaction between teams and all or part of the organization with its ecosystem (suppliers, economic, institutional and academic partners etc.). Thus, the increased recognition of inventiveness and innovation as essential differentiating factors in an increasingly competitive world, the rise of the collaborative economy involving sustained exchanges between peers and the strong interest in introducing a principle of co-creation into innovation projects strengthens, disseminates and even invites us to rethink the OI, interpersonal relations and governance.

In such a context, in order for the system to function and develop itself an optimal and fluid way, it is useful to identify what can stop or - on the contrary - stimulate the motivation of individuals to engage as co-creators or at least contributors to a process over which they seem to have no control.

This paper focuses on the links between trust, technology and co-creation. Indeed, research shows that trust is a key success factor in the development of organizations and the integration of users into open innovation processes, as we will see in the next section. In addition, (Greco, Locatelli and Lisi, 2017) highlight the potential contributions of OI to the energy sector with the key role of five variables: (1) government involvement, (2) university involvement, (3) customer and supplier involvement, (4) absorptive capacity and (5) innovation novelty. More specifically, in the world of energy distribution, co-creation represents an opportunity for the development of customer relations and value creation (for example, the design of new technology or new services). The challenge is to put the user at the centre of energy innovation, at the beginning of the value chain, in trades and practices that are more oriented towards technological innovation (Dupont *et al.*, 2017). This evolution of the context offers the opportunity to understand, and even measure, as soon as possible in the arrival of new practices, the contribution of user integration to the innovation process in the field of energy services.

Thus, through two energy-related case studies, we will illustrate how trust is a major issue, particularly in situations where projects are based on research by a wide diversity of actors in both quantity and quality (i.e. fields of expertise, focus of interest). Finally, we will propose to highlight and articulate technologies that promote the mobilization and support of stakeholders in the co-creation process. We are therefore talking about technologies related to collaborative approaches and organizations. The latter include tools, methods, digital systems (from Web 2.0 to immersive devices), or even physical spaces that allow and facilitate the work of groups composed of eclectic people, distributed or not, in synchronous or asynchronous work (Recker, Mendling and Hahn, 2013; Tran, 2014; Bayrak, 2015; Dupont *et al.*, 2018). We are thus seeking to identify the “ideal” functionalities that should be fulfilled by one or more complementary technologies to support co-creation. Where appropriate, we also look to see in which cases technology facilitates, or on the contrary hinders, the emergence and appropriation of ideas. The challenge is to verify that an idea is appropriate or rejected for what it is, and not because of the technology used to bring it out and represent it or because of the initial actor who carries it. Through the outline of a functional specification, we will more specifically highlight the characteristics that an integrated technological device or a set of technologies reinforcing Open and Agile Innovation must offer.

2. THE CHALLENGE OF TRUST FOR INNOVATION

2.1. Trust: an essential lever for inter and intra-company innovations

The performance of an OI approach can be enhanced by, for example, reducing the time to market for new products or services. Working on the robustness of the process can be beneficial, for example by ensuring that it is more in line with users' needs. The OI can also become more eco-responsible by mobilizing processes that respect the principles of sustainability by favouring short circuits, socially responsible choices, the well-being of employees, etc. One of the common denominators of all these areas for improvement is trust. It is found at all levels of an organization and can be a lever for development: trust between peers in a community of co-creators, trust between companies and external contributors, trust between a company and its employees, trust between partners, trust in the methods and tools underlying the OI.

Trust contains three dimensions (Mayer, Davis and Schoorman, 1995): (1) benevolence (the perception of a positive orientation from one person towards another); (2) ability (group of skills, knowledge, know-how in a particular domain); (3) integrity (“relates to the perception that the other party adheres to a set of principles and values that the trustor finds acceptable, such as delivering on promises” (Shazi, Gillespie and Steen, 2015)). Taking these principles into account, it can be seen that several levels of maturity in terms of trust can be observed and developed within companies and their partnership relations. Thus, researchers propose a model that ranges from “limited trust” to “collaborative trust” (Fawcett, Jones and Fawcett, 2012).

Within companies, the research of (Pirola-Merlo, 2010), using West's “innovative team climate” model, shows that there seems to be a positive correlation between a team's climate and the speed of completion of a research and development project. Four dimensions characterize this climate (West, 1990): (1) the sharing of clear and valued objectives; (2) a non-threatening environment where members can influence discussions and decisions; (3) the pursuit of excellence through quality work and critical evaluation; (4) the valuing of innovation and supporting working practices to achieve innovation. (West and Sacramento, 2006) recall that some authors consider that learning and innovation can only take place when group members trust the intentions of other members.
In 2014, a study conducted on a panel of 48 member companies of the German Maintenance Services Association shows that three elements are needed to achieve a medium to high level of innovation: contracts, trust in a supplier to respect collaboration and ability to fulfil the obligations agreed between the parties (van der Valk *et al.*, 2016). These same studies show that in order to reach certain levels of innovation, certain thresholds must be respected for each of these three parameters. Under certain conditions, innovation performance depends very directly on the level of detail of contracts and the quality of trust established between partners.

At the enterprise level, the establishment and maintenance of trust-based-relationships in B2B reduces risks, transaction costs and long-term relationships (Dovey, 2009). This is particularly true for innovation and creativity processes (Shazi, Gillespie and Steen, 2015).
Innovation requires creativity and a certain amount of risk taking, so the results are uncertain and unpredictable, making it impossible to draft precise terms and clauses of a contract in advance. More flexible and flexible mechanisms are needed to guide a partnership or collaboration, in which it is necessary to balance trust between partners and the establishment of contracts. In addition, a 2011 survey (Wang, Yeung and Zhang, 2011) of 315 Chinese companies shows that while, in certain circumstances, contracts and trust can replace each other and guarantee the same performance, in situations of uncertainty trust between the parties is much more effective than the (costly) implementation of contracts. Managing an OI project requires the ability to understand and anticipate the environment in which the project will be deployed.

2.2. Trust at the heart of user engagement and collaboration

Living Labs (LL) are also an original development of the OI (Arnkil *et al.*, 2010), where the notions of trust and contract are strong issues. Indeed, LLs as innovation networks require the establishment of strong links of cooperation and collaboration. In the context of LL, this cooperation is done with the users who are at the heart of the projects. From experience, (Guidat *et al.*, 2011; Dupont *et al.*, 2014, 2015; Dupont, Morel and Guidat, 2015), we can point out that projects in LL mode induce tacit contracts between participating users, project leaders and potential method leaders without being able to guarantee the intellectual (and/or industrial) property of what could be produced. In addition, the mobilization of actors is generally based on mutual trust which must be built and nurtured.

We suggest to transfer the work of (Shazi, Gillespie and Steen, 2015) on innovation networks within business projects to LL projects. Thus, we recognize that users bring different skills depending on the subject and the time of mobilization (diagnosis, idea generation, feedback, etc.) to provide expertise and know-how useful for innovation. On the other hand, in all cases, their benevolence is required and necessary. It remains a nodal point in the relationship being built. Research shows that integrity is also a fundamental characteristic. A competent employee who lacks integrity will be actively avoided in the setting up and development of innovation projects. Our experience with LL projects has confronted us with some recurring questions from user participants in relation to project sponsors: What will be done with our contributions? Do we serve the general interest or a particular interest? Will our expression be respected? Conversely, project leaders, who adopt a LL approach aimed at involving users in their approach, sometimes wonder about the integrity of the actors who will join them: will they respect a certain confidentiality if it is required? Will they be in line with our values? Will they be “sincere” or “authentic”? In practice, since it is impossible to verify *a priori* the full interoperability between participants, facilitators and project leaders, it is necessary to accept that actors withdraw or are excluded during the process.

2.3 Co-creation and trust: forgotten by collaborative technologies?

A study conducted in 2018 on collaborative immersive environments (Dupont *et al.*, 2018) provides interesting insights into the notion of trust and co-creation. The analysis, based on 23 scientific articles published since 2000 in international journals and one thesis, highlighted four recurring dimensions for Collaborative eXperience: (1) Sense Making; (2) Trust Building; (3) Shared Meanings; (4) Mutual Understanding. This study also identified two properties by dimension, respectively: context understanding and relevance; interpersonal relationships and trust; knowledge sharing and knowledge creation; group dynamics and collective intelligence. (Dupont *et al.*, 2018) reveals that two properties are not very well researched: trust and knowledge creation. The small number of studies on collaborative immersive technologies that focus on these properties raises questions about the importance given to concepts that are at the heart of collaborative processes, which are by nature open and by nature part of a knowledge creation process, consubstantial with the innovation process.

The various elements from the literature underline the fundamental nature of trust for each member of a company, for example through the belief in his or her own abilities. Trust between the members of a company is also necessary to ensure balanced and profitable relationships. Trust must therefore be found between the hierarchical and functional levels. Finally, loyalty is an essential factor in an organization's relations with its partners and other stakeholders in its environment, particularly when it comes to involving users in the process. More generally, it is also a question of having confidence in your market and your ability to adapt to more or less predictable changes.
Despite the relevance and clarity of these findings, it still seems difficult to establish and maintain relationships of trust. Although context and technology can respond to a number of challenges on an ad hoc basis, there are still obstacles to overcome in order to strengthen trust at the different levels we have been able to identify. It seems necessary to understand and equip the processes of the upstream phase of innovation to ensure an agile and open innovation process that fills the gap.

3. METHOD: COMPARISON OF CASE STUDIES FROM LONGITUDINAL EXPLORATORY RESEARCH

In this article we adopt a case-study approach (Yin, 2013). This method allows us to shed light on the question of trust through the complementary analysis of two case studies of open innovation applied to the field of energy distribution for two European countries (Switzerland and France), both of which have been the subject of a Living Lab initiative over a relatively similar period. The innovative nature of the deployment of OI approaches for companies in this industrial sector encourages us to capitalize and analyse concrete experiences to develop and characterize transposable methodologies. This work also allows us to provide additional analyses to the research of (Greco, Locatelli and Lisi, 2017) who deplore the small number of studies on OI for companies in this sector.

Thus, the first case presents part of the results of a longitudinal exploratory research conducted during the creation of the Energy Living Lab (ELL) in Switzerland, whose challenge is to create an innovation ecosystem to promote the co-creation of energy services for one of the 700 energy distributors. This project, developed as part of Mastelic's thesis work, was presented at the conference of the French Association of Marketing 2015.

The second case presents the French project Link by Makers (LbM) of the University of Lorraine. This project, driven by academics and makers (i.e. members of a FabLab), received the support of ENEDIS, the French electricity distributor, as a way to experiment with some form of OI around the smart meter installed by the distributor who manages 95% of the French grid. This project was presented at the IEEE / ICE Conference 2017 (Dupont *et al.*, 2017).

Two different teams of researchers designed these cases independently. The first team, involved in a Swiss LL, conducts research on marketing and innovation management. The second, engaged in a French LL, does research on industrial engineering and innovation management.

The two case studies that we will detail below emerged in different contexts, but in both cases the researchers considered that the stakeholders concerned in each situation trusted each other. They also assumed that users trusted the process set up by academics to generate a real co-creation dynamic. The first works presented independently validate the ability of processes to generate co-creation. The cross-referenced analysis of the two teams' feedback on the implementation and management of these two cases allows us to return to the premise of the trust placed a priori in the process by the stakeholders. The latter is not automatic. Barriers to change can be avoided. Good practices have been identified to establish a climate of trust between stakeholders in an innovation process that is open over periods of six to eighteen months. Finally, technological levers seem to be able to be used to accelerate this innovation process and guarantee its agile nature.

3.1. The Energy Living Lab: an innovation ecosystem to promote the co-creation of energy services

This case study describes one of the first projects of the Energy Living Lab. It began in autumn 2013 and lasted 2 years, in a context of transition in the Swiss energy sector. Indeed, during this period, distributors moved from a monopolistic status in their jurisdiction, with captive customers, to a competitive context, in which customers are free to choose their energy distributor. The challenge of this ELL project is to use co-creation to develop customer relations and create value for the partner company. The method followed is structured in four steps: (1) the formulation of the challenge, (2) the co-creation platform, (3) the target audiences, (4) the nature of the data collected, as well as the successive steps of data processing and analysis.

3.1.1. The formulation of the challenge

The formulation of the competition of ideas must be precise enough for the distributor to develop the resulting ideas, but also broad enough to allow the participation of the persons solicited, who do not come mainly from the field of technology. The question was defined by the company and then pre-tested with 30 people. The question asked was: “What would energy efficiency be like in practice for you? What advice, products, services would you like to have to reduce your energy consumption? What services would you like to see to help you reduce it?”.

3.1.2. The co-creation platform

The co-creation platform www.i-brain.ch developed by the Swiss company Atizo in partnership with the University of Applied Sciences Western Switzerland (HES-SO) is used as a virtual interface. This platform allows (1) the generation of ideas by soliciting one or more target groups, (2) the pre-selection of ideas by a jury of experts and (3) the evaluation of ideas pre-selected by one or more target groups. In the idea generation phase, the objective is to collect as many ideas as possible from the target populations. Then a jury of experts selects a specific number of ideas. These are then submitted to the target populations for evaluation and sequencing.

The ideas proposed on the platform are open and visible, with a view to cross-fertilization: some people's ideas enrich others' ideas. The platform's interest also lies in its automation: automatic reports can be drawn for the phases (1) idea generation (2) idea selection and (3) idea evaluation, which allows managing a large amount of data very quickly.

3.1.3. Target audiences for co-creation

In order to generate as many varied ideas as possible and to allow the cross-fertilization of ideas, as in traditional brainstorming, several target audiences were selected. We are looking for users who are likely to be motivated to provide ideas for new energy services and also users with innovative ideas. The objective is not in this idea generation phase to be representative of a certain sample of clients. Especially since at the time of the challenge, a customer of the distribution company in question differs from a customer of another distributor only by his place of residence. Around 500 people participated, from the following communities:
- *The company's customers:* 30 000 customers (households) were invited by email to give ideas on an online platform. This represents 10% of the total for this type of customer. Most have little contact with the company (annual electricity bill) and little knowledge of energy.
- *Members of the energy efficiency community: the* company has developed a website that provides a wealth of information on energy efficiency. 5000 people have registered voluntarily in this community and can also share their experiences. They are not necessarily customers of the company. It can be assumed that they are motivated to provide ideas for energy services and that these are ideas that could have value for the company since they are informed on the topic of energy efficiency. They were also invited by email to give ideas.
- *HES-SO Bachelor and Master students:* 4707 HES-SO Bachelor and Master students were invited by email to participate on a platform dedicated to them. The hypothesis made by the research team is that students have fewer filters and may propose less standardized ideas than clients and members of the dedicated community. Of course, most of them do not yet pay electricity bills, but they do consume energy. The company's challenge is more focused on the needs for services that could help users consume less than on the marketing of these services.
To avoid collecting ideas only with customers or users connected to the Internet, *physical interfaces* were also organised to collect ideas at three public events for which students collected ideas from visitors through flyers.

3.1.3. Data processing and analysis

The challenge was offered for one month, from mid-September to mid-October 2014. In the idea selection phase and in order to select the 30 best ideas from the ideas initially submitted, two juries were set up. A jury of experts from within the company and an external jury from outside the company. The objective of forming two separate juries and leaving them completely free to choose the idea selection process is to compare the ideas selected by the internal and external experts to test whether there is convergence or divergence, expressed by the number of ideas common to both juries.
The jury of internal experts (an energy efficiency expert, an energy communication expert and a business line manager) had the task of selecting the 15 best ideas according to the process of their choice. This was divided into three distinct phases: an individual evaluation of each idea according to three criteria (relevance of the idea, innovative nature of the idea, technical feasibility of the idea), a pooling (pre-selection) of similar selected ideas and a final screening to define the best ideas.
On the other hand, an external jury composed of professors from the HES-SO working in the field of energy also had the task of selecting the 15 best ideas. The 12 weighted selection criteria defined by this group are presented in Table 1.

Table 1 - 12 criteria for selecting ideas

Criteria	Weight
Achievable (technical / time)	5
Compatible with legislation	3

Social impact	2
Social acceptability	4
Economic / financial impact (community)	3
Economic / financial impact (utility)	5
Economic / financial impact (consumer)	3
Green mobility	3
Impact on the production of renewable energies	5
Reduction of energy consumption (electricity)	5
Reduction of energy consumption (heat)	5
Energy return time (cost / bn, efficiency)	4

Subsequently, the 30 ideas (15 from internal and 15 from external experts) were submitted in parallel to the two groups in order to compare the evaluation and sequencing of ideas from the different groups.

3.1.4. Results of the empirical study

The results of the three phases, (1) idea generation (2) idea selection (3) idea evaluation, are presented and discussed below.

3.1.4.1. Results of the idea generation phase

The objective of the regional electricity distributor was to collect at least 300 ideas, i.e. 1% of the total number of customers who were invited to participate by email.
In this project, 530 ideas were collected by the following three contact points: (1) 21 ideas by students on a dedicated internet platform (2) 436 ideas by users during the three events via flyers (3) 73 ideas by customers and community members dedicated to energy efficiency on another dedicated internet platform. More ideas were collected through physical interfaces at events (436 ideas) than through purely virtual interfaces (94 ideas).

3.1.4.2. Results of the idea selection phase

It appears that out of the 15 ideas selected by the HES-SO expert jury, 5 ideas came from the student group and 10 from the customer and other users group. Of the 15 ideas selected by the company's internal jury, 4 came from the student group and 11 from the customer and other users group.
The radically different evaluation processes, the unevenness of the criteria chosen and the very dissimilar composition of the two expert groups partly explain the divergence of opinions expressed on the ideas adopted and highlight the exploratory approach of this study. Moreover, none of the ideas selected are common to both juries.

3.1.4.3. Results of the idea evaluation phase

Once the 30 ideas had been selected, the idea evaluation process could begin. In this two-week phase, it was important to determine what ideas could be converted into products, services and offerings that could be offered by the company. Three questions were defined as criteria for evaluating the ideas, in collaboration with the company: “How do you rate this idea?”, “Would you like this service/product to be set up for your household?” and “Would you be willing to contribute financially to its implementation?” These three questions help to understand whether the ideas proposed in the initial phase have a commercial future for the company and can serve as a basis for the development of product/service concepts in a later phase.

In concrete terms, 83 people from the target population evaluated the 30 ideas selected. As shown in Table 2, this evaluation shows that the total number of points obtained by the ideas proposed by the student group ranges from 6.72 (min) to 9.18 (max), while the total number of points obtained by the client and other user group ranges from 5.45 (min) to 9.14 (max). Note that the maximum number of points was 14. The winners from both groups were selected, personally informed and rewarded.

Table 2 - Average scores of the evaluations of the 30 selected ideas, on the three evaluation criteria

30 ideas selected by the juries	21 ideas proposed by users																					9 ideas proposed by students								
How do you rate this idea? (average)	3	4	3	4	3	3	3	4	3	4	2	4	4	4	4	4	4	4	4	3	4	3	4	4	3	4	3	4	4	5
Would you like this idea / service to be in place for your household? (average)	2	2	2	3	2	2	2	3	2	3	2	3	2	2	2	2	3	3	3	2	2	2	3	2	2	3	2	2	3	3
Would you be willing to participate financially for its implementation?	2	2	2	2	2	2	1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total of points	7	8	7	9	7	7	6	8	7	9	5	8	8	8	8	8	9	8	9	6	8	8	8	8	7	9	7	8	9	10
Ranking	17	12	15	4	14	16	20	7	18	2	21	6	8	13	10	9	1	5	3	19	11	6	4	5	8	2	9	7	3	1

Of the 30 ideas selected by the two expert juries, 9 come from the generation process with students, including the idea with the highest score and the idea with the 2nd highest score (tied). In the case of this French-speaking company, the process carried out with a public of students who are not its short-term customers was an asset; out of 21 ideas submitted by students, 9 ideas (or 43%) were selected by the juries. Of the 509 ideas submitted by clients and users, 21 (or 4%) were selected for the final evaluation. It was therefore interesting to have carried out this work in parallel with two separate groups; the group of students, used to being solicited in order to generate ideas and solutions, was an important source of ideas valued by the two juries.
It would be interesting to measure this difference in the appreciation of ideas between a group of users and a group of students during an in-depth study. Mixing the groups has therefore proved to be a wise methodological choice.
On the other hand, if we analyse in more detail the average scores of the 30 ideas that have been evaluated, we can see from a Student test that the average score of the ideas issued by students (8.12 points) is not significantly different from the average score of the ideas issued by clients/users (7.59). Similarly, the average of the internal jury scores (7.38) is not significantly different from the average of the external jury scores (8.11), the overall average being 7.74 points. This would suggest that the juries selected more ideas from students in relation to the number of ideas submitted, but that in this step of evaluating the 30 ideas selected, ideas from both target audiences are on average of equal quality.

For confidentiality reasons, the company did not wish to share the complete list of ideas with their respective evaluations but communicated on the three winning ideas in a press release.

3.1.5. Putting ELL results into perspective in terms of trust

Users' interest in co-creation was measured by the number of ideas submitted by users in the different contexts (physical and virtual interfaces). The number of responses desired by the economic partner was achieved, but it was necessary to switch from the virtual interface to a physical interface in order to stimulate face-to-face users (see Table 3). The challenge presented had to be explained during these interactions, which could suggest that the question was too technical or complex, and that it was not appropriate by users, which could have been a barrier to participation via the virtual interface. The research team hoped that the participation rate through virtual interfaces would be higher. Their confidence in the ability of users to address this issue individually and virtually was overstated.

Table 3 - Synthesis of the results of the co-creation process implemented by ELL

	Distributor's customers	**Members of the energy efficiency community**	**HES-SO Bachelor and Master students**	**Total**
Number	30 000	5000 (some of which may be from customers)	4707	between 30 000 and 39 707
Participants	Around 500			Around 500
Ideas submitted via Internet platforms	73		21	530
3 Dedicated events	436		Not Concerned	
Origin of the selected ideas	21		9	30
Average of the scores assigned (via Student test)	7.59 points		8.12 points	7.74 points

The ideas selected by the company nevertheless raise several technical, legal or operational issues and the company carries out further analyses to confirm their feasibility and, if necessary, the implementation modalities. It should be stressed, however, that no ideas proposed were considered to be really new and many of them were redundant, which is not surprising in an idea generation phase where the aim is to understand the latent needs of users. These raw ideas must then continue a long way in the innovation process to be transformed into concepts, then into prototypes and finally into services. This raises questions about the real value added by the different parties. The critical phase is to continue the design of the service after this ideation phase within the company, at which point the risk of the "*not invented here syndrome*" (Chesbrough, 2011) may appear, which is characterized by the rejection of ideas not generated within the company and blocking the process.

The company's approach underlines the company's clear desire to integrate the user at the heart of the discussions; the profound changes that the energy market in Switzerland is undergoing have a direct impact on the company's internal culture and a genuine global opening strategy makes it possible to prepare it for market liberalisation (the implementation of an Internet exchange platform, which is at the same time informative, incentive and collaborative, is now a testimony to this global approach initiated).

Physical interfaces seem to bring a greater number of ideas than purely virtual interfaces. Three hypotheses could explain this point: (1) the energy is not "*top of mind*" with the users questioned and it is necessary to stimulate the group face to face so that it gives ideas, (2) the challenge posed was badly formulated and not very comprehensible for non-experts, (3) the virtual interface does not offer enough guarantees in relation to the uncertainty generated by the approach (need to reassure and answer quickly the questions or misunderstandings that direct physical relations facilitate).

The group solicited seems to have an influence on the number and quality of ideas submitted. The student group submitted more ideas in proportion to the number of people invited. Ideas from this group were considered to be of better quality (more ideas selected on a *pro rata* basis to the ideas submitted). The company that participated in the research has recently begun to change its relationship with its customers in view of the forthcoming liberalisation of the electricity market for households in Switzerland. It is possible that the relationship of trust and loyalty is not yet strong enough for customers to engage in co-creation via a virtual platform. Because as (Cova and Cova, 2009) highlight*, "the process of governance underlying the new consumer's discourse must remind companies that they must not believe that all their customers have succumbed to the formatting of the creative consumer and that they all now have the skills to dialogue, play a role and integrate the company's offers",* this process takes time and requires several iterations before they can transform their customers into change agents.

The divergent opinions of the expert groups can be explained by various hypotheses; the internal jury is under the influence of a latent internal strategy, a realism as to the applicability of the ideas suggested or a *"time-to-market*" reflection. However, there is no evidence that the composition of two external and homogeneous juries would have led to selections of converging ideas: the flexibility left to the juries as to the organization of the selection process accentuates the exploratory process of such a study. This may also be due to the *"not invented here*" syndrome mentioned earlier. However, the interest in seeking ideas from outside the company, as Chesbrough points out, is to overcome this syndrome by working on openness, particularly in a monopolistic environment. We therefore come back to the question of the confidence of the company's members in the outside world.

If the Swiss case study allows us to understand the intangible dimension of creativity through a process of generating raw ideas, the French case study on the smart meter allows us to deepen the transition from idea to prototyping in a context of mobilizing very eclectic actors among a population not clearly identified.

3.2 Case study 2: Linky by makers, an OI project between industry, academia and makers

3.2.1 Project context and target audience

Linky by Makers (LbM) questions the use of smart meters and smart grids. This project began at the end of 2015 during an exchange between industrialists, academics and makers within the Lorraine Fab Living Lab® (www.lf2l.fr), a platform for the prospective evaluation of the uses and acceptability of innovations of the ERPI laboratory and the ENSGSI (School of engineers specialised in innovation) (Dupont, Morel and Lhoste, 2015). LbM has received the support of ENEDIS and UL in the continuity of a collaboration initiated in 2009 and strengthened by the "Chair REVES" project (Dupont, Morel and Guidat, 2015). At the instigation of Nancy-based makers networking with other French makers, this project, initially planned for 6 months, was extended by 12 months in part because of trust issues.

Between 2013 and 2022, ENEDIS is to deploy 35 million smart meters in France. These meters are the property of the electricity distributor. The meter itself is in the process of being installed for commercial operation. The "smart meter" product can be described as "finished" but the smart grid system will only be fully operational when all the meters are installed on French territory. Furthermore, the ongoing technological and industrial transition and the issues it raises generate controversy (Assemblée Nationale, 2016) that we will not study here.
LbM is part of an open innovation logic based on the principle that academics, consumers and suppliers can work together (Carayannis and Campbell, 2012), in particular to understand the uses of a technology that is still little known to the greatest number of people, even though we

are all electricity users. The experimental project posits the following hypothesis: makers who are used to "tamper with" could: (1) to be an avant-garde community that enriches the understanding of the possible uses of the meter (via additional developments in open hardware); (2) to support a reflection on new forms of production / consumption / use of electricity from so-called smart grids.
The project's objective was then to allow the French FabLabs, or those who considered themselves makers, and who were interested in the question of energy, to take up this challenge themselves. The University positions itself as a research support to help stakeholders communicate with each other, share ideas, capitalize on and analyse the experience.

Launched in 5 French regions via 5 "Regional" FabLabs (FLR), the project was to be completed in June 2016. However, there was an underestimation of the time required to prepare the conditions for the success of the project. E.g.: there was a delay of several months between the signing of the agreements between the partner FLRs and University to allocate funds to them (travel expenses of the makers, purchase of equipment etc.), there was an imprecision on the operating methods, expectations etc. this having contributed to a strong demotivation which deeply questioned the continuation of the project.

After a crisis in June 2016, a new start was made in September 2016 on the basis of an analysis of the first few months, an understanding of the difficulties, a validation of the partners who were still motivated... The challenge was to better consider each other's practices and rhythms while introducing a sustainable method of distributed collaborative engineering. We also opened the network of participants by offering students of the FabLab association students from ENSGSI, the GSI Lab which has access to LF2L. Finally, LbM's partners have committed themselves until the end of June 2017 by signing a joint agreement (6 signatory partners). At the end of this period, 30 idea sheets were produced, 8 prototypes were developed and tested. These prototypes, which are more related to everyday life, are intended to facilitate the use of Linky's functionalities and form the basis for potential projects. The codes associated with these prototypes are freely accessible on the Internet. On the other hand, two projects with a higher ambition and relating to the implementation of community systems were suggested by the makers.
In parallel, the academics presented their scientific results at a conference and submitted to ENEDIS a comprehensive technical report describing the results of the co-creation process as well as the ad hoc method developed in an agile way for open collaborative engineering. All the results of the project were presented to entrepreneurs and citizens interested in energy issues at the 2nd Forum of "Transitions and Governance(s) of Energy" (April 2018, Lyon) in connection with "Daisee", an Internet of Energy initiative (https://daisee.org). These different meetings seem to lead to a networking of projects and individual energy.

3.2.2. Technologies deployed to support co-creation

By proceeding in an iterative and constructivist manner, the research team, in interaction with the participants, deployed and accompanied or adapted the use of the following collaborative technologies:
- The Slack collaborative platform (https://bymakers.slack.com) to capitalize on and cross-reference the reflections, questions and suggestions of all participants (makers, academics, industry group).
- The ENSGSI creativity platform, filing of idea sheets, "48h Innovation makers" (http://ensgsi.kalanda.info/ENSGSI), allows participants (makers, academics, industrialists) to

file and consult all the ideas and projects imagined. A rating system (1 to 5 stars) allows participants to vote for ideas.
- The LF2L physical platform lent to local associative Fab Lab to access the tools during the project. LF2L hosts specific events organized with the manufacturers (LbM launch, "energy" Hackathon, stage point with ENEDIS) and is used by academics involved in the production of prototypes (unrestricted use, at the request of volunteers). E.g.: 9 creativity and prototyping workshops were organized by LF2L during the first half of 2017.
- The Github platform (https://github.com/LF2L) to capitalize and present prototype projects. These elements produced under "open source hardware" license are shared and can be improved by the community interested in smart meters and Smart Buildings. This platform therefore makes it possible to strengthen co-design between participants (makers, academics, industrialists).

3.2.3. Putting LbM results into perspective in terms of confidence

Finally, LbM's main challenge is to get actors from different parts of France to collaborate with each other, with different timeframes (full-time and/or occasional contribution, paid or voluntary, etc.), different practices, etc. In other words, it is a question of articulating 4 dimensions (Dupont *et al.*, 2017): (1) ***Geography*** with FLRs in 4 different regions, themselves composed of actors distributed in their territory leading to a lack of face-to-face interactions (lack of spontaneity); (2) ***Conceptual*** because "creativity", "energy", "open source / hardware" does not refer to the same representations and uses according to the actors, moreover the project started with an approach in creativity (i.e. producing abstract concepts with an academic method) while the makers are in the "make" (disassemble, reassemble, reproduce, transform, etc.), finally LbM brought together and confronted structured organizations and very agile or fuzzy organizations with sometimes contradictory governance modes; (3) ***Technology*** with a strong initial limit, the distributor did not want to lend smart meters and the participants had no in-depth technical knowledge on this technology or on other aspects of the project (measuring electricity, developing objects in open hardware, working in open source, etc..); (4) ***Time***, which is expressed in terms of the time available to participants according to whether they can invest themselves over 6 months, 2 years, the time of a weekend, etc. Time also concerns the management of the knowledge produced: how to leave contributions that others can take up and enhance?
Beyond these four barriers to be overcome to ensure collaboration, this case study highlights three observations related to the process of identifying and co-creating the uses of electricity distributed by smart grid: (1) Each has its own practices and objectives: an "engineering" company with an industrial strategy, academics with a research project, FabLabs with their specific history and logic of action and different interests, etc. (2) The makers (at the time of the LbM project) are finally not very interested or accustomed to energy issues, moreover, it is necessary to learn to give concrete expression to intangible elements (energy, electricity, trust, data, communication etc.); (3) The Integration of users in the product launch phase, when irreversible strategic decisions have been taken, is too late which inhibits self-determination and the motivation to be part of a co-creation process. It is a question of co-constructing a vision shared by all the actors in the upstream phase.

Like the Swiss ELL context, the French context has largely conditioned the predispositions of the actors to collaborate, requiring the transcendence of individual and specific practices and centres of interest strongly rooted in each other to build a community of interest in a vague and tense context (Assemblée Nationale, 2016).

Finally, we can summarize the management of the LbM project in 5 challenges that had to be overcome to create a favourable climate of collaboration between the actors: (1) Having a common representation of the project; (2) Ensuring interactions between communities at the right time in a process under construction; (3) Developing governance compatibilities through peer-to-peer negotiation; (4) Managing internal and external communication; (5) Giving a concrete explanation to intangible elements and use different media to materialize both the project process and its outputs. We are aware of the non-exhaustive nature of the approach to be taken, particularly with regard to energy transition issues. The work of (Koirala *et al.*, 2018) highlights in particular the importance of local communities to involve citizens and users in the development of new responses as community energy systems. This study also shows that trust in the local community is one of the key factors for engagement.

4. Towards a support system for trust in co-creation

4.1 Lessons from the two case studies

The two experiments we have carried out and studied allow us to highlight the challenges related to building stakeholder confidence at the different levels of an Agile and Open Innovation project. Beyond the limitations encountered in the implementation of projects, their observation and analysis give us the opportunity to better understand the mechanisms in place between communities distributed and solicited to contribute to a common project. The researchers' commitment to the design, installation and animation of the processes and the extensive nature of the analyses we were able to produce from these two projects, respectively 24 and 18 months, allow us to access both a quantitative and qualitative reading of these original research materials. Figure 1 thus presents the main technological elements deployed to support co-creation in ELL and LbM projects and foster trust between stakeholders. The physical or virtual platforms mobilized are classified in order of appearance in the process of each project. This diagram also indicates the quantitative productions resulting from each of them.

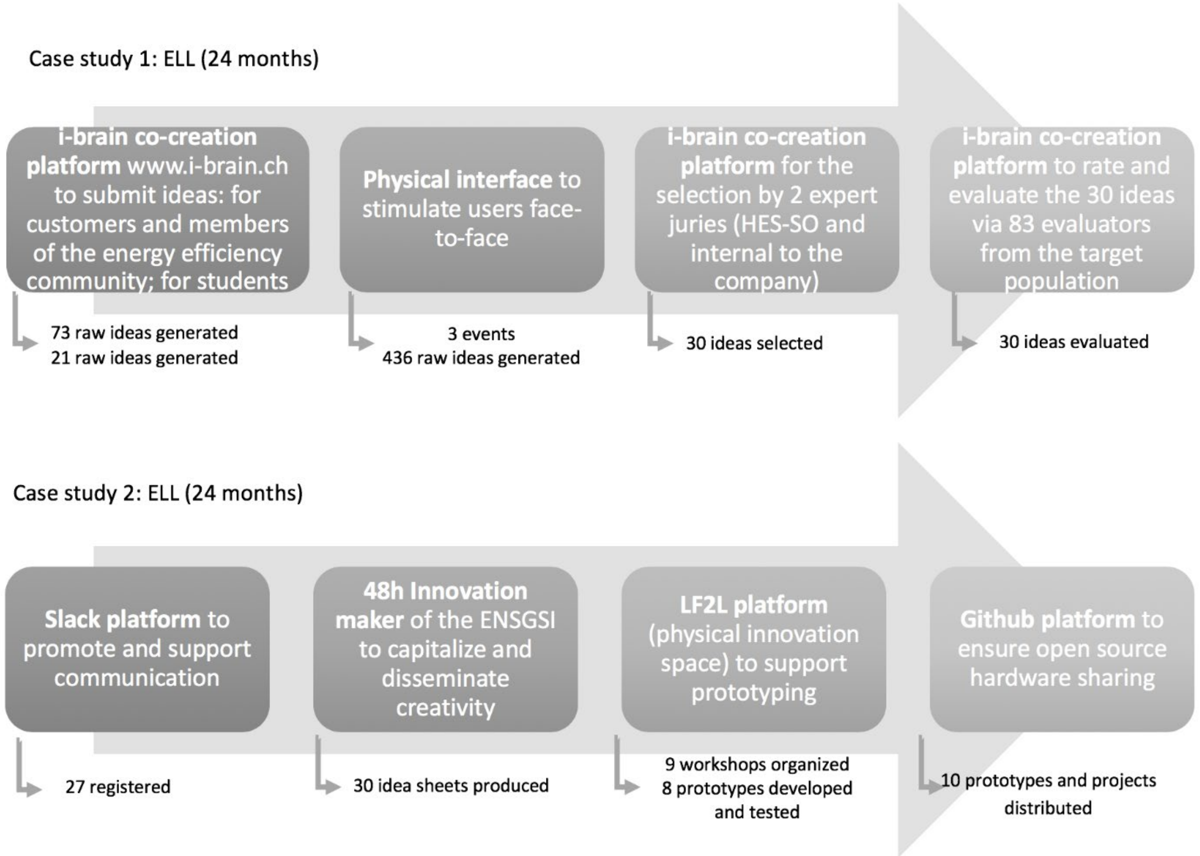


Figure 1 - Sequential vision of the complementarity of the support platforms for co-creation within the ELL and LbM projects (adapted from (Dupont *et al.*, 2017))

Based on the observations and analyses reported in Chapter 3, we can improve each of these processes in order to strengthen co-creation between the actors. Figure 2 thus describes the additional technologies or functionalities that it would seem interesting to add in the light of the feedback. It appears that two functions are not yet fulfilled by any of the projects: the appropriation within companies of ideas generated outside and the ability to retain and engage consumers or communities in a co-creation process involving a company. In both cases, it should also be pointed out that academics have probably played a role as trusted third parties in the process and in the issues submitted to users. The proposal to support service design designed by ELL can be assimilated to the practice of LF2L and implemented for the LbM project, and finally, the prospect of the emergence of a platform connecting buildings, consumers and producers is specific to the French case, and therefore not yet generalizable.
For each platform and technology, it is necessary to consider the trust that users place in them, as well as the role that these technologies play in the level of trust that stakeholders place in each other. How does the integration and implementation of these technologies generate a favourable climate among stakeholders to build mutual trust and collaborate together? In other words, by drawing on the elements of the literature relating to trust, how to ensure that these technologies encourage an Open Innovation process: (1) benevolence; (2) the ability to fulfil the “obligations” agreed between the parties; (3) sharing and adhering to clear and valued objectives; (4) the emergence of a non-threatening environment where the parties can contribute and influence decisions by being recognized and valued in their contribution; (5) the pursuit of excellence through quality work and critical evaluation; (6) the enhancement of innovation and support for working practices to achieve innovation.

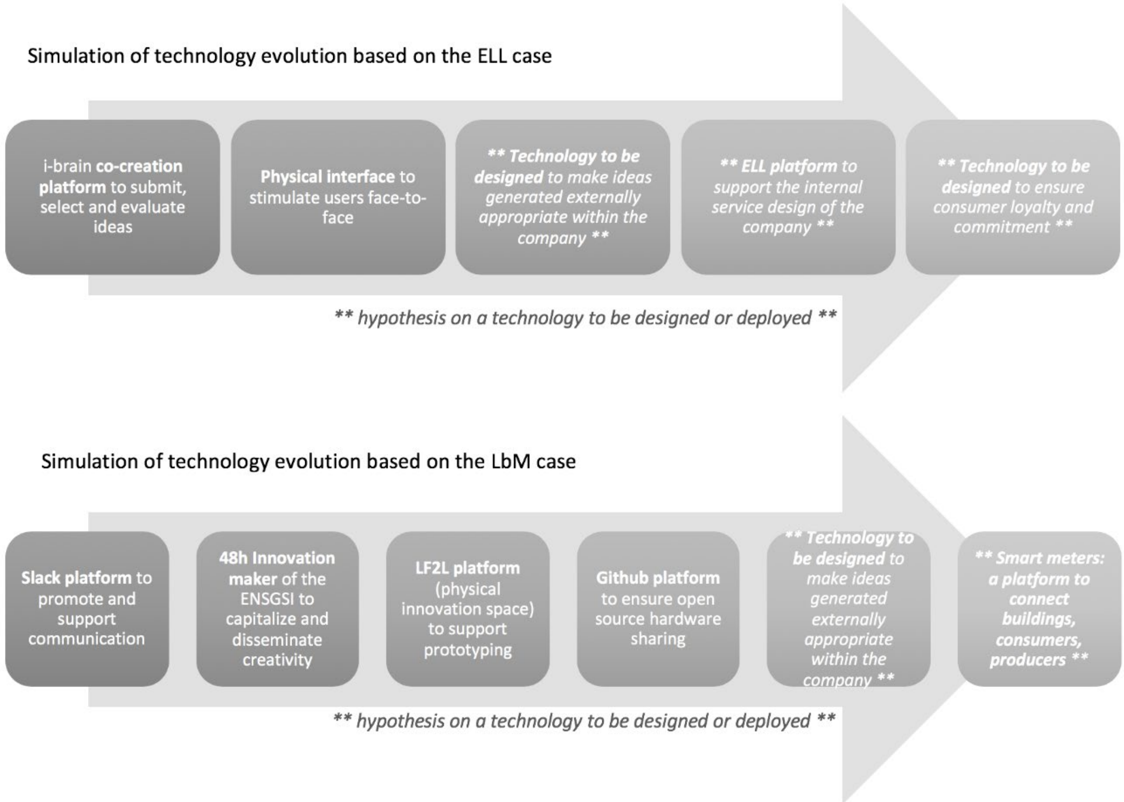
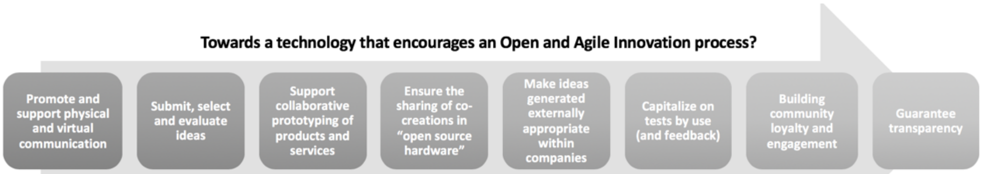


Figure 2 - Proposed evolution of technological supports to strengthen co-creation for each of the ELL and LbM projects

4.2 Outline of an integrated process for co-creation

In the light of the previous findings, we can outline a process with new technological responses. Figure 3 below thus proposes an integrated vision of good practices to establish a climate of trust between the stakeholders in an open innovation process. This potential process is built by aggregating and scheduling the feedback from the two case studies. We have identified eight main functions that a technology or a consortium of collaborative technologies must perform to strengthen co-creation and trust in an Agile and Open Innovation process: Communication, Ideation, Materialization, Contribution, Ownership, Validation, Compensation, Publication. The definitions we use for these functions come from the cases studied and our experience in the field of co-creation project management. The sequential presentation of functions follows the order of occurrence observed on the practical cases, without freezing these steps, which can sometimes be carried out concurrently. Feedback loops, or at least iterations, should also be considered.

To characterize and refine the eight functions that a technology or a consortium of collaborative technologies must perform, we have crossed them with the determinants of trust within an innovation process. This method allows us to sketch a matrix, called “Co-coon” (for co-creation, confidence and trust), which we have completed from the work presented in the previous chapters. The content of the matrix constitutes a first basis for reflection and work for researchers and practitioners as a guide to good practices and possible avenues for implementation.



Fonctions / trust	Communication	Ideation	Materialization	Contribution	Appropriation	Validation	Remuneration	Publication
Benevolance	Within and between communities	Let the ideas express themselves	Give implementation to a third party	Let others modify your idea	Valuation of ideas, agile methods	The right to make mistakes for oneself & others	Identifies contributors	Possible anonymity
Ability of the parties to fulfil their obligations	Get to know each other better	Conceptual skills	Prototyping skills	Computer skills	Corporate culture	Shared evaluation criteria	Sharing of capital gains	Task distribution
Sharing clear and appreciated objectives	Describe the framework for each	Specify the selection procedures	Show progress towards objectives	Expose and share the 1st results of the co-creation	Bringing communities together	Commit to objectives and adapt them if necessary	Listening to needs	Respect the objectives or explain drifts
Non-threatening environment to contribute and influence decisions	Dispelling misunderstandings	Expression of divergence	Materialize to guide the choice	Enable co-construction	Encourage collective and team spirit	Impact criteria	Reward the contribution	Keep a record and be able to consult it
Achieving excellence through quality work and critical evaluation	Encourage listening and interaction	Deepen and compare ideas	Confront ideas with their feasibility	Seek improvements through the collective	Accepting constructive criticism	Confronting ideas with usage	Ethics of compensation	Evaluate the impact and terms of sustainable development
Valuing innovation and supporting practices	Multiply the modes of communication	Encourage the submission of ideas by teams	Relying on innovation spaces	Develop smart contracts	Disseminate the innovation process	Sharing feedback	Towards shared properties?	To be part of the prospective

Figure 3 – Co-coon Matrix to strengthen co-creation, confidence and trust in an Open and Agile Innovation process

5. CONCLUSION AND PROSPECTS

In this article, we have recalled the fundamental aspect of developing trust within innovation processes to guarantee and amplify their open character and strengthen agility. Nevertheless, the literature highlights the lack of research to understand and accurately characterize the mechanisms underlying the establishment of shared trust in collaborative processes, such as co-creation. Two case studies based on a greater consideration of users in the field of energy distribution and management allow us to illustrate and highlight some of the determinants of trust in co-creation. This longitudinal study on projects that took place between January 2014 and July 2017 would need to be supported by the exploration of new data from specific oriented work on this subject. For example, putting the user or consumer at the centre of an innovation process and at the heart of service development does not guarantee their loyalty and commitment. On this point, seeking to test the statistical correlation between the implementation of co-creation methods and the appropriation of the services thus developed by users would legitimize this approach. Because as Gassmann and his colleagues (Gassmann, Enkel and Chesbrough, 2010), there is a lack of measurement of the effectiveness of these methods. It would also be relevant to conduct research in other industrial fields to validate the generic dimension of the proposed model to support the open and agile innovation process (Figure 3). We have deliberately not integrated the technologies of the smart meter into the latter. These make it possible to collect usage data in near-real time, opening up new perspectives in the relationship with the user and the development of service offers for customers. The creation of these data by users, their collection and use is the subject of a democratic debate in France (Assemblée Nationale, 2016). The controversies in several European countries about smart meters also underline a certain distrust of these newly deployed technologies.

Moreover, the recent a priori diffusion of the OI paradigm in the energy sector (Greco, Locatelli and Lisi, 2017) may generate different practices from industrial sectors already largely engaged in this logic. A comparative approach would undoubtedly strengthen the Co-coon Matrix we are proposing. Finally, the intangible, even abstract, nature of energy and electricity seems to make it difficult to mobilize neophyte actors on issues that can quickly become technical or at least require the assistance of specialists to shed light on particular points. A greater effort in communication, vocabulary creation and shared representations seems necessary to overcome this difficulty. The development and use of innovation spaces that bring stakeholders together and collaborate could provide a favourable framework for the emergence of collective intelligence (Morel, Dupont and Boudarel, 2018) in the service of projects and ecosystems. To enhance the efficiency of our model, the time dimension will also need to be studied. Indeed, our two case studies describe projects that span almost two years. Is it a constant or a contest of circumstance? Minimum durations should be measured to ensure the success of each step of the Co-coon Matrix. And to evaluate how the industrial domain concerned, the diffusion of OI, and societal engagement influence the temporality of the process.

More generally, all the elements of the Co-coon Matrix can be the subject of an experimental program to consolidate and enrich this first proposal with a better consideration of trust in open and agile innovation processes. In addition, Co-coon Matrix proposes functional building blocks from a multitude of physical and virtual platforms. Based on this model, it would be interesting to study the possibility of deploying a digital technology that integrates all these functionalities and that would be the "digital twin" of a physical platform dedicated to collaborative innovation generating a framework where the appetite for creativity is truly released. The recent emergence of the blockchain (Nakamoto, 2009) in support of the decentralized system of trust seems to offer new perspectives in many fields such as democracy (Caseau and Soudoplatoff, 2016) or manufacturing. This technology also seems to provide specific answers to the challenges of co-creation (Seulliet, 2016; Patrick Duvaut, Seulliet and Shavit, 2018). Technological building blocks combined with a relevant organizational model could therefore offer a climate of trust in the communities of co-creators and give meaning and motivation to the actors involved in open innovation processes.

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