COLLABORATIVE DESIGN OF VALUE IN CREATIVE PROJECTS: AN EXPANSIVE VALUE MANAGEMENT MODEL

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Abstract

Facing the necessity to increase their innovative capabilities, organizations are beginning to launch more and more creative projects aiming to introduce radical changes into organizations by exploring new technologies, users, ecosystems or business models. However, the fact of going beyond existing markets and established technologies implies great difficulties and uncertainties for practitioners to manage the value created by such projects. After reviewing the historical development of the two traditional models of value management in project management literature, we show that VM progressively shifts from an evaluation to a design activity. We argue that this shift permits to better embrace the dimensions of creativity and innovation involved in the projects. Drawing on the recent advances in innovation management and design literature, this research investigates the nature of the outputs (i.e. *what* is the value to be managed?), the ways to manage the value (i.e. *how* is the value to be managed?), and the beneficiaries (i.e. *for whom* is the value to be managed?) of creative projects. Based on a longitudinal case study with Renault, we examine how the value is managed in a creative project under Renault's research program involving the next generation of electric vehicles. We formulate our framework around three main propositions: (1) the value resides in the exploration of the common unknown: in short, the concepts (e.g. new ideas relating to products) and the evaluation criteria that are out of the dominant design scope and for which the CPs team members are interested in (2) the value is designed by managing the distance between the trajectories of the CP and the dominant design (3) the value is beneficial to the emergence of new ecosystems.

Keyword: value management, design, creative project, creativity, innovation

1. Introduction, plan and objective

1.1. The issues of value management in creative projects

Facing the necessity to increase their innovation capabilities, organizations are launching more and more *creative projects* (CP) aiming at introducing radical changes into the organizations by the involvement of new technologies, users or ecosystems (Lenfle, 2008; O'Connor, 2012; Obstfeld, 2012; Paulus and Yang, 2000). Instead of focusing only on the development of efficient and short-term innovation products, it has been argued that firms must also move beyond local search in order to access distant and unfamiliar knowledge and competencies (Katila and Ahuja, 2002; March, 1991; Rosenkopf and Nerkar, 2001). Exploring new areas of knowledge offer great opportunities to challenge the current dominant design of an industry by creating new product categories, envisaging new markets or transforming industrial structures. Over the last five years, the management of such creative projects have gained crucial attention from scholars who consider CP as a special class of project with specific resources, activities and deliverables (Gillier et al., 2012; Hatchuel et al., 2005; Le Masson et al., 2010; Lenfle, 2012, 2008; McGrath, 2001; Sutton and Hargadon, 1996).

As the fundamental purpose of any project is to create value, evaluating and managing the performance of creative projects is of prime importance. Inspecting the value of a project enables the identification of some of the major benefits for the stakeholders, measure the success and thereby improve its overall efficiency. However, such evaluation is difficult and authors have shown that creative projects can be eliminated too early (Elmquist and Le Masson, 2009; Van Oorschot et al., 2010; Zhao et al., 2012). Creative Projects often start well whereas their outcome in terms of delivery seems fuzzy; the people involved in CPs do not seem to know exactly the nature of their activities vis a vis the scope of technology, markets, or societal issues to be addressed. Most of time, the value determined at the project onset is very different from the value obtained at the end of the project. Detailed studies in this line have shown that the current project control procedures tend to inhibit learning, innovation and creativity (Keegan and Turner, 2002; Lenfle and Loch, 2010). Furthermore, the objective of CP is different from new product development projects meaning CP participants are not in charge of developing new commercial products, whereas their objective is to explore broad innovation fields (Gillier et al., 2010; Hatchuel et al., 2005), to develop "the competence to build new competency" (Danneels, 2012, p. 519). In such circumstances, the parameters for

evaluating CP cannot be the same than those used in new product development. In line with this, (Elmquist and Segrestin, 2007; Keegan and Turner, 2002) have shown that evaluation criteria do not exist ex-ante but need to be created during the project. So, how can we evaluate and manage such specific project? What are the good indicators of creative projects?

1.2. Motivation and research questions: project value management as a design activity

Developed in the early 50's, *Value Management (VM)* is still one of the most famous project management practices that enables organizations to measure and control the value generated during a project (Dell'Isola, 1966; Jones, 1963; Miles, 1961; Zimmerman and Hart, 1982). However, innovation in projects raises theoretical and managerial issues for VM: for instance, how can one evaluate the value of a solution that does not exist yet but needs to be invented? For whom the value has to be managed in the absence of existing markets?

Since mid-90's, extensive research has been carried out to expand the scope of VM for coping with the CP specificities. Generally, research shows that projects which have high level of uncertainty and innovativeness require management principles that are substantially different from those involved in more rule-based projects (Burns and Stalker, 1961; Lenfle, 2008; McDermott and O'Connor, 2002; O'Connor and DeMartino, 2006; Tidd and Bessant, 2011). Recently, a few scholars have emphasized that for CP, the value is not analyzable before the start of a project; thereby, the value does not pre-exist but it needs to be designed and developed: *the management of value shifts from an evaluation activity to a design activity* (Elmquist and Le Masson, 2009; Elmquist and Segrestin, 2007; Hatchuel et al., 2005; Le Masson et al., 2010; Lenfle, 2012). In this new perspective, the value is not considered to be known but the value must be entirely designed. Thus, VM is no more considered as a final task aiming at *evaluating* the performance of projects, but rather a departure point for *designing* new product/service ideas along with new competences. This paradigm shift threw some more light on the specific links between design literature and VM. In the design and innovation management literature, pursuant to the seminal works of (Simon, 1969), there is a considerable body of knowledge that argues that humans are not limited only in their rationality to evaluate pre-existing alternatives but that they encompass an "expandable" rationality that enable them to generate radically both new alternatives and also new evaluation criteria (Dorst, 2006; Elmquist and Le Masson, 2009; Fredberg, 2007; Gillier et al., 2012; Hatchuel, 2001; Hatchuel et al., 2005; Kazakci, 2012; Lenfle and Loch, 2010; Lenfle, 2012; Porac and Tschang, 2013). However, the conditions and the process of VM within a

design perspective still need to be investigated. Based on recent advancements in terms of innovation and design theories, this article proposes to investigate the ways under which the value is managed in creative projects. Our research investigates the three following sub-research questions:

1) In CP, *what* is the value to be managed?
2) In CP, *how* is the value to be managed and what are the appropriate indicators?
3) In CP, *for whom* is the value to be managed?

1.3. Plan

The plan of the article is as follows:
In section II, we review and compare the two historical VM models of project management (the "hard" and "soft" VM) with the recent innovative developments in management and design literature. Our analysis stresses on the fact that VM gradually moves from a stable design regime where the project attributes the tasks, the timetable, the customers or the resources required, to an innovative design regime where the value and the beneficiaries are completely (or at least partially) unknown. In section III, our research methodology is introduced. We conduct a collaborative management research (David and Hatchuel, 2008) at Renault, the major French car manufacturer. The CP studied in this research is the "Low Carbon Emission Mobility" project (LCEM) aiming to develop new businesses for the next generation of electric vehicles. In section IV, the key propositions for managing value in CP are exemplified through the LCEM case study. Three main propositions are then introduced: (1) the value resides in the exploration of the common unknown, meaning the concepts (e.g. new product ideas) for which CP's team members are interested in but they do not have sufficient knowledge to develop them. (2) The value is designed by managing the distance between project trajectories and the dominant design; (3) the value is beneficial to the emergence of new ecosystems made up of an innovative network of stakeholders that share a common unknown regardless of their firms' membership. In section V, we conclude by comparing these principles to the two previous VM models, i.e. the limitations and proposal for further research.

2. Analysis of literature

In this section, the « hard » VM approach (2.1.) and the « soft » VM (2.2.) are introduced. We will show how VM progressively shifts from an evaluation paradigm to a design paradigm. To conclude the analysis of this literature, we'll highlight the contribution as well as the limits of innovation and design literature to conceive VM as a design paradigm.

2.1. The "hard" VM: Converging toward solutions by the clarification of the outcomes to deliver

The root of VM may be found in the development of value analysis (also called value engineering) occurring during the mass production context of WWII. In the VM literature, this philosophy is often referred as the "hard" VM paradigm (Dell'Isola, 1966; Jones, 1963; Miles, 1961, 1949, 1946; Zimmerman and Hart, 1982). In 50's, Lawrence D. Miles, a purchase engineer at General Electric, formulates the premise of value engineering (Miles, 1961, 1949). In his book titled "Techniques of Value Analysis and Engineering", multiple methodology steps called "Job Plan" are presented: 1- information searching: clarification of the mission – benchmark and state of art ; 2- analysis: analysis of the functions and their associated cost and commercial value ; 3- creativity : generation of alternative ways to improve value and to meet functional requirements; 4- judgment: evaluation of performance and the cost-saving of all the alternatives. ; 5- development planning: identification of tasks and actions required to reach the final value. The "Job Plan" is further exemplified with various case studies such as manufacturing a temperature control, a metal strip hinge or an X-ray equipment. According to Miles, VM is successful if the "product or service has appropriate performance and cost" (p.5). Miles' methodology is a systematic methodology to develop and compare alternatives in order to deliver the most satisfying solution to a pre-determined problem. According to the author, studies may be carried out only after the problem is correctly defined and thus requires some pre-investigation of these five questions: "What is the item or service? What does it cost? What does it do? What else would do the job? What would be that alternative cost?" (p. 18).

In Miles' view, managing the value mainly consists of managing the relationships between the function and the cost: the valuable solutions are those which fulfill functions at the lowest cost. This view of value is clearly stated by the motto reported by (Johnson, 1958) for speaking about the use of value management in the Bureau of Ships: "more ships for less dollars" (p.77)

Value analysis is still today one of the most popular tools in engineering and manufacturing communities. This approach is largely deployed in numerous industries like construction (Bowen et al., 2010; Male et al., 2007; Naaranoja et al., 2007) and it is validated by several international standards (AS/NZS 4183, 1994; SAVE, 1998). A lot of methodologies have been proposed in order to correctly identify what the customer wants (e.g. Functional Analysis System Techniques, Quality Function Deployment…), to eliminate all the unnecessary costs (e.g. cost analysis methodologies…) or to compare several alternatives with multi-criteria analysis methodologies.

2.2. The "soft" VM: converging toward solutions by the clarification of the stakeholders' expectations

Strictly applying Miles' basic conception of VM is not sufficient for "soft" project, which is rather characterized by unclear and intangible goals, the involvement of multiple stakeholders and the creation of several complex alternatives; (Green, 1997) claims that VM is undergoing a "Kuhnian paradigm shift" and therefore a new wave of VM techniques has been proposed. For (Green, 1997), "*The traditional literature on Value Engineering (e.g., Dell'Isola, 1982; Miles, 1972) invariably assumes that design problems are both well-defined and static over time. Clients are further assumed to be unitary in nature and able to articulate objectives which are both consistent and transitive."* (p20) and he concluded: *"The concept of optimization is seen to be entirely inappropriate for the multi-perspective human problem situations which characterize the early stages of building design. This is particularly true for multi-faceted clients."* (p20).

From planning an activity and positivist philosophy promoted by "hard" VM, VM methodologies have progressively shifted to a more social constructivist activity emphasizing the inter-subjective creation of knowledge. In this second perspective, VM was mainly used to manage a social process that monitors the progressive convergence of multiple stakeholders and about what constitutes the value and the outcomes of a project. In this perspective, VM was no longer an exclusivity of engineering teams in R&D and final customers but the needs and expectations of many other people such as internal stakeholders (Marketing, R&D, strategy department…), external partners (distributors, suppliers..) and even employees. Thus, as may be seen, the VM literature evolved beyond engineering product development toward a more holistic and upstream approach such as strategic project management, early briefing phase of building project or program management (Ellis et al., 2005; Thiry, 2002; Yu et al., 2005). In view of the same, (Green, 1992) proposes the following definition: "*Value*

management is concerned with defining what 'value' means to a client within a particular context. This is achieved by bringing the project stakeholders together and producing a clear statement of the project's objectives. Value for money can then be achieved by ensuring that design solutions evolve in accordance with the agreed objectives. In essence, value management is concerned with the 'what', rather than the 'how'".

Further, (Green, 1994, 1992) proposed the SMART methodology that permits key project stakeholders to ensure the development of a shared understanding of project objectives. This methodology aims to prioritize the project objectives and needs in order to assure that the decisions regarding the project (solutions, ideas…) would be accepted by all during a project's life-cycle. Along this line, (Thiry, 2001) pointed out the essential process of sense making during VM workshops in order to ensure a continuous value awareness by the stakeholders. He claimed that sufficient time must be allocated so that the stakeholders can make sense of their common problems, discuss personal cues of a situation, and construct shared view of the situation and of the different alternatives to be pursued. (Liu and Leung, 2002) proposed a VM model for soft system where the final target is achieved through several interactions between the customers and the team members. They claimed that VM must pay greater attention on the phase of team goal definition by explicitly clarifying the client's and participant's values and goals. In addition, they argued that taking time to specify the project goal will only increase participant commitment and satisfaction. In order to reduce the divergence of interests during the project, several authors have proposed to improve the briefing phase where the customers' requirements are collected. (Yu et al., 2005) have suggested a value management framework in order to systematically identify and formulate the customer requirements, and in the process they identified 13 variables that have strong influence on the briefing process. In order to better manage the collaboration between stakeholders, (Luo et al., 2011) recommended a group decision support system which could increase the customers' participation in the clarification of requirements, generation of ideas and selection.

2.3. Managing the value in creative project: from evaluation to design

2.3.1 The crisis of traditional value management for creative projects

However, the differences between the "hard" VM methods (Dell'Isola, 1966; Jones, 1963; Miles, 1961; Zimmerman and Hart, 1982) and the "soft" VM methods (Green, 1994; Male et al., 2007; Thiry, 2001) are not completely obvious and lead to several polemics in the

literature (see for example, the debate between (Ellis et al., 2005) and (Green and Liu, 2007)). In short, the "soft" VM technique seems to be useful only for the early stage of projects, then, gradually, the "soft" VM merges with the "hard" VM. The "soft" projects are progressively transformed into "harder" ones. Particularly, "soft" VM uses the "functional language" of "hard" VM tools and techniques (see for instance, the SMART methodology proposed by (Green, 1992) or (Thiry, 2001) who claimed that "Functional analysis (is a) `frame of reference'" (p74) for "soft" projects).

More fundamentally however, our analysis of literature stresses the fact that both "soft" and "hard" VM,, share a major assumption: the two latter VM models are thought to be within a stable regime perspective; and under a stable regime, VM is deployed from the moment when one knows quite well: (1) what is the "object" to deliver and (2) who are the "beneficiaries" to be involved in the project.

(1) Indeed, in the "hard" VM perspective, VM is conceptualized as a planning activity that could be split in two distinct phases: a phase comprising of the problem definition and a phase comprising of a problem solving ability and the execution of tasks at hand. At the start of VM workshops, the final target has to be defined as clearly as possible. The description of the product or service (i.e. its functional and technical analysis) and the description of the customers' value (i.e. what the customer wants) have to be precisely formulated. Once the need or the objective to attain is known, then the value analysis provides "an ordered way for selecting the best among the alternative system which could fullfil" (Liu and Leung, 2002). *In this version of "VM", the execution of the efficient VM methodologies and techniques requires to previously clarify what is the "object" (final product, service…) to produce at the end of the project. An effective "hard" VM is a process that generates the same value that was analyzed at the beginning of the project. So, how can one use "hard" VM if the "object" does not exist at the start?*

(2) In the "soft" VM perspective, VM is conceptualized in a more social constructivist activity emphasizing the inter-subjective creation of knowledge through which the problem and the solution evolve together. These social aspects are often symbolized by the first step of a project, the briefing phase, during which the different stakeholders meet together, explain to each other what their respective priorities are in a hope to find a common scope of value and final target. *In this version of "VM", the execution of the efficient VM methodologies and techniques requires to previously*

clarify who are the "beneficiaries" to involve in the project. An effective "soft" VM is a process that generates the value for the beneficiaries who was identified at the beginning of the project. Still, how can one apply "soft" VM if one does not know for whom the evaluation is made?

To summarize, in "hard" and "soft" VM, VM can start from the moment when the "object" and the "beneficiaries" are known. Unfortunately, these two conditions of stability are inconceivable in the case of CP. Once one knows what is the value to deliver and for whom, by definition, the creative process is over. Because one does not know the final "object" to achieve, it is not possible in CP to deduce the appropriate tasks, actions and steps to follow as suggested in "hard" VM, or to deduce the missing competences and the right stakeholders as indicated in "soft" VM. Managing value in CP cannot be considered as a prescriptive activity obtained by a prior analysis of a product or an existing system; the "track" to follow cannot be planned in advance. Rather than controlling the tasks, the schedule, the responsibilities, which will be necessary for converging toward the expected final value, VM in a creative project requires methods and techniques grounded on a radically different logic (table 1).

<table>
<tr><th></th><th>Main focus</th><th>Main underlying theories</th><th>Boundary assumptions</th><th>Assumptions challenged by creative projects</th></tr>
<tr><td>"Hard" VM</td><td>How to deliver the expected value?</td><td>Problem solving and search</td><td rowspan="2">VM is applied within the conditions of stable-design regime :

The problem, the object and the beneficiaries are known. The value of the final solution is known at the outset.</td><td rowspan="2">VM in innovation-design regime :

✓ The deliverables are (partially) unknown
✓ The valuable markets are (partially) unknown
✓ The list of beneficiaries (customers, stakeholders…) is (partially) unknown</td></tr>
<tr><td>"Soft" VM</td><td>What is the value for the stakeholders?</td><td>Sensemaking and stakeholders theory</td></tr>
</table>

Table 1: The basic assumptions and challenges of "Hard" and "Soft" VM in creative projects

2.3.2 Value Management: toward an expansive design perspective

Innovation and design literature offers several insights to better frame the VM in innovative design regime. One important result is that the design process of a project cannot be done before or after the evaluation process but in the meantime. For instance, based on the study of the Manhattan Project, (Lenfle, 2012) argues that evaluating it with the classic quality/cost/time framework is misleading. Rather, the author proposes to use a recent design

theory for tracking and evaluating the high scope of knowledge and concepts generated during the whole project. In the same line, a frequent recommendation is to avoid evaluating a creative project with the conventional quantitative criteria such as financial tools like discounted cash flow and the net present value; but other authors propose to use the option theory in a flexible way, where the design of new solutions creates new options (Fredberg, 2007; Paulson et al., 2007). (Leifer et al., 2001; Loch et al., 2007) insist on the fact that leading a project with "trial and error" approaches enable teams to discover unexpected and new values. Along the same line, (Chiesa et al., 2009), based on (Simons, 1994), underline that managers do not frame the process of creativity with rigid and standardized procedures but they rather continuously discuss the corporate value and missions of the organizations. (Hooge and Hatchuel, 2008; Maniak, 2010) show that the value cannot be only calculated in terms of economic or business value but may be created in other forms as well (e.g. ethical value, ecological value, strategic value…). An important recommendation regarding the ways to evaluate creative projects was proposed by (Hatchuel et al., 2005; Le Masson et al., 2010) . They showed that the value of CP does not refer to a final product or to a specific solution but more broadly to an innovation field. An innovation field could be defined as a broad design space in which an organization aims to carry out innovative activities by expanding an initial concept along with its knowledge base. The authors suggest assessing the quality of an innovation field by examining: *"concepts that, after development, become commercial products ; Concepts that have been explored but adjourned due to lack of time or resources. ; New knowledge that has been used during the creative and can be reused on other products (e.g. components, technical solutions, new uses, and so on) ; New knowledge that has not been used during the creative but can be useful for other products."* cited by (Lenfle, 2008) (p. 473).

Despite this interesting framework for evaluating creative project, questions still remain: 'How can one know if ones design is in the "proper" direction? What are the rationales for deciding which concepts and fields of knowledge are suitable to focus on? How can we efficiently control this expansive process? Furthermore, the beneficiaries of creative projects are unquestioned: who can be interested by the results of creative project, in other words, for whom is the value to be managed? The present research aims to contribute to answering these open questions.

3. Research methodology and data

3.1. Case study of a creative project in a collaborative research: Building an industrial research strategy without customers' feedbacks

This research bases itself on an analysis led by Renault, a French global carmaker, to build a step-by-step research strategy project for its future generation of Electric Vehicles (EV). This research was conducted from December 2010 to January 2012. As a preliminary initiative, Renault's first mass Electronic Vehicles for private use was in the form of Fluence Z.E. and Zoé, which were launched in January 2012 and March 2013 respectively. Managers of the research department faced a very stiff challenge as at first they had to identify and plan the Research project for the next generations of EV without any prior experience, comments and/or feedback. Within this particular context it would be interesting to note that at the end of 2010 when the project was at its early stages, one of the authors was asked by Renault to assist them by providing reflexive feedbacks and appropriate methodologies for managing a creative project.

This research collaboration was built on a long-term on-going partnership since 2004 with mid-level managers from the Research and Advanced Engineering Department, on tools and organizations for innovation capabilities. The research methodology adopted is thereby a collaborative research carried out by academics and practitioners who aim to link the theoretical gaps with practical problems encountered by firms (Shani et al., 2008).

From a research perspective, it was an opportunity for longitudinal, participatory field studies on creative projects. This kind of research methodology is well acknowledged to open possibilities of mutual learning between these two social worlds. The research follows the main intervention principles that aim to produce actionable knowledge for practitioners and create new scientific models (David and Hatchuel, 2008; Radaelli et al., 2012). Intervention research is specifically recommended for research whose objective is not to validate existing theories statistically but rather to revise existing theoretical models and to formulate new ones (David, 2001; Radaelli et al., 2012). This research is based on a single case-study explored through multiple data collection methods, which in turn allowed researchers to improve grounding of theory by triangulation techniques (Einsenhardt, 1989; Yin, 1990). Such research methodology has been largely used by previous scholars for exploring issues in the

management of (hybrid) electric vehicles project (Midler and Beaume, 2010; Pohl and Elmquist, 2010).

3.2. Choice of the case study: introducing creative changes in an automotive organization

The EV project was selected as a suitable case for investigating the value management of creative projects, because these new kinds of vehicles offset most of the traditional project management models in the automotive industry in terms of value dimensions, such as the technologies used along with the business model, underlining once more a paradigm shift in the automotive industry (Midler and Beaume, 2010). , Therefore, electric vehicles, which in the past were seen as risky projects in the automotive industry, due to its numerous commercial failures, became the main focal point of research today. (Aggeri, Elmquist, Pohl, 2009).

Environmental policies had compelled the company to actively look for new technologies, uses and business models for vehicles with low carbon emissions. In 2009, Renault decided to deeply involve French R&D departments in an Electric Vehicle strategy. At the beginning of this research, the first EVs were still in the development phase and not yet sold on the market. Only concept cars had been shown in international automotive events. Although Renault's decision-makers had a few feedbacks about customers' acceptance regarding the first generation of EV from marketing surveys, they were aware that on-going development projects of EV were likely to deeply change skills, customers' product representations, design processes and industry organizations.

At the end of 2010, despite the fact that the firm was already involved in many projects of technological research and advanced engineering on this topic, top-management of the Renault Research Department decided to launch a dedicated project, called *Low Carbon Emissions Mobility* (LCEM project), in order to incorporate new technologies, uses and business models that could improve the competitiveness of the VE for the next twenty years. The LCEM project aimed to forecast and structure new long-term strategic domain of learning for the Research Department. The official purpose of the project, as it was communicated inside the firm, was to identify "competitive targets" for 2030 on low carbon emissions mobility and to propose a roadmap of learning on innovative concepts based on electric vehicles' technologies, business models or uses to reach them. Consequently, the leader of LCEM project was in charge to elaborate a coherent Research Program, i.e. aiming

to produce new knowledge on an identified issue, whether technical, economic or social. The goal stated was to explore new potential arenas for disruptive business for the future range of electric vehicles, but no direction was given to the team, except that it must be "*different of what Renault used to do, also different of what we will do with first Renault's EVs*" and "*contained some proofs of potential profitability*", according to the manager of the project. Due to the high degree of project radicalness, this project assembled a network of heterogeneous and cross-disciplinary stakeholders of Renault innovation process who had little or no experience working together in the past. Despite the fact that cross-functional collaboration was not unusual in the firm, the formation of the workgroup was characteristic of a creative project, as a few dimensions of breakthrough of the dominant design had to be studied simultaneously, and that consequently brought people from engineering, marketing and forecast departments to delve into this exploration together without making some of them natural leaders of the team.

3.3. Data collection

The data was collected by one of the authors who was involved as an active member in the project during the three main phases of LCEM: the definition phase (February and March 2011), the collaboration phase (April to September 2011) and the building phase (October to January 2012). Our implication in the empirical field permits to collect rich materials regarding VM. These data have been categorized in three main codes: value creation, valuable beneficiaries and value indicators.

Primary data was mainly collected through direct observation of 26 meetings: 10 face-to-face meetings with the team leader of LCEM project, 6 management meetings where the project leader and his managers defined more specifically the kind of outputs they expected from the creative project, 7 workshops with the entire project team. The project's team assembled a network of sixteen heterogeneous stakeholders of Renault innovation process. Nine of them were internal R&D managers and technical experts on various skills from battery management system, aerodynamics, car architecture, combustion engine, ergonomics and automatic. Four members came from technical forecast and business intelligence departments specializing on electric/hybrid vehicle technology and market, and on new mobility devices and services. The last three members came from strategic marketing department, which focused on customer behaviors and expectations. Even if they all used to contribute the dominant design process, they have never been involved simultaneously in a unique activity

of designing new value for potential businesses dissociated from the traditional ones of the firms. According to the process decided during the definition phase, the first three workshops were spent on knowledge gathering and sharing on EV solutions, Zero emission services and new mobility systems. This step aimed to build an extended knowledge review on long-range sustainable mobility systems and business models. This first part of the creative project allowed identifying strategic knowledge areas and their availability for the firm (available, on-going learning and missing knowledge). The next three seminars were innovative design workshops, based on tools from Concept-knowledge theory of design reasoning (Hatchuel and Weil, 2009; Hooge, Agogué, Gillier, 2012). The aim was to collectively explore new links between low carbon energy systems and long-range mobility solutions. Relying on a systematic modeling of strategic knowledge formerly identified, the project team built during those seminars, three stepwise roadmaps on three distinctive innovation fields. The last seminar was devoted to a deepening of potential value that emerged from each axes and identification of valuable synergies.

Our involvement in these different meetings was as participant in the first three and the last one, and as facilitator during innovative design workshops — permitting to collect data regarding the value created during the LCEM project. Value creation included 4 main items: (1) all the "concepts" generated during the project, i.e. covering concepts of new technologies (e.g. new configuration of battery), new product ideas (directly related or not to automobile industry), new market opportunities (e.g. electric car-based services for rural mobility) or new business models (e.g. creative value chain with business partners); (2) the extended list and description of all the past and present projects developed by Renault on low carbon emission mobility from hybrid engine devices to inter-modality services and business models (3) the benchmark of suppliers and competitors' projects and products (4), the learning during the project on creative combinations of knowledge, potentially valuable for the firm (e.g. by analogy with innovative solutions from other industry).

Furthermore, our implication permit to finely understand the internal group dynamics process by collecting data regarding how the value was managed, it means for instance: the discussion among the team members regarding the value of the different concepts generated, the LCEM project evaluation of the Renault Research Department, the reasons and motivation of project orientations, or the project members' preferences and disagreement.

In addition to those meetings, eight semi-structured interviews were done to deepen with project team members the collective mechanisms of value identification and collaborative building of the research strategy. Moreover, three meetings with potential external partners were led by the project leader to validate the potential of some disruptive concepts for external value beneficiaries on long-range sustainable mobility.

Finally, a last management meeting has been conducted in January 2012 with the project leader and his manager to decide the kind of visual representation of the stepwise roadmap. This meeting was of key importance for creative project understanding as the work on value was perceived as being almost finished by the LCEM project team but the nature of outputs — disruptive concepts of technology, uses and business models — was still confusing for top-managers of R&D regarding their department routines.

A synthesis of the data collection process is given in Table 2.

	Definition phase (February and March 2011)	**Intensive collective phase (April to September 2011)**	**Building phase (Until January 2012)**	**Total**
Definition of meetings with project leader and Research Managers	3 Validation of the collaborative process of the creative project, team composition	2 Validation of emerging research strategy and value indicators	1 Validation of innovative fields and nature of outputs	6
Meetings with project leader (Debrief of meetings with managers / theory building on management of value creation axis and identification of value indicators)	1	4	5	10
Methodology definition and training sessions with project leader (Definition of the method of the collective process of value creation and innovative design trainings)	3	1	0	4
Project workshops and seminars	0	6	1	7
Collaborative meeting with potential partners (external value beneficiaries of new concepts)	0	3	0	3
Interviews of workshops' participants (expectations and assessments of LCEM project)	2	3	3	8

Table 2: Data collection in LCEM case-study

3.3. Data analysis

In order to provide a systematic analysis of the VM process, a framework analysis was developed. This framework was a design tool derived from Concept-Knowledge theory of innovative design reasoning (Gillier et al., 2010; Hatchuel and Weil, 2009). This tool permitted to follow step by step the VM process of LCEM project and to interpret our three main codes (value creation, valuable beneficiaries and value indicators). This tool was created and used during the individual debriefing meetings with the project leader; this explicitness in strategy enables multiple iterations and confrontation between the theoretical propositions and the data observed in the LCEM projects – it constituted the first step of theory building process (Eisenhardt, 1989).

Regarding the value creation code, our framework enables us to analyze three main results of LCEM project: it offered a structured diagram of all the creative concepts generated, a comprehensive overview of the knowledge involved (knowledge used could be well mastered, on-going learning or knowledge gaps for Renault) and resources mobilized along with a detailed description of the relationships between the concepts imagined and the knowledge. At the end of each project workshop and seminar, this analytical framework was refreshed in collaboration with the project leader to include additional concepts and knowledge. During the innovative design seminars, the project leader and the researcher proposed preliminary models as stimulus to collective interaction, which were then debated and enriched by the entire workgroup through intensive assessment of each concept's value creation. Concerning the beneficiaries, a systematic identification of benefits or impacts on the industrial ecosystem was documented: each of the concept and knowledge elements was associated to a more or less extended list of beneficiaries within and outside Renault. Thus, beneficiaries identified could be already in Renault's ecosystem but also new potential partners coming from non-automobile sectors.

Finally, concerning the indicators of VM process, the stimulus were also used to support rich interactions on value indicator as assessing the potential value of concepts was a key issue to select research projects within the roadmap. Indeed, such Concept-Knowledge representations enable to track the different directions taken by the project teams (i.e. the different design paths envisaged by the project teams). The ideas and the knowledge that constituted the design paths were monitored by comparison with the traditional elements of the dominant design in the car industry (e.g. internal combustion engine, four wheels, unique sell business model, etc.) and value chain organization (assembler, supplier, sellers, partners, etc.). Each

design path was positioned within a continuum range from well known (i.e. the design path is closed to the automobile dominant logic) to fully unknown (i.e. the design paths challenge the automobile dominant logic in simultaneously few dimensions, technology, uses and business models).

4. Findings from the creative project of "Low Carbon Emission Mobility"

This section provides an in-depth description of how value management has been handled during the three main phases of LCEM: the definition phase (February and March 2011), the collaboration phase (April to September 2011) and the building phase (October to January 2012). For further clarity, our three main theoretical propositions (P_1, P_2, P_3) are introduced and encapsulated with the case study. In Section 5, the propositions are discussed in more theoretical perspective.

4.1- What is the value to be managed in CP? The definition phase

First, from February to March 2001, the main issue the project leader had to overcome was to clarify the goals and objective of the creative project and the nature of outputs expected from the managers. Three meetings were conducted with the managers of the Research department in order to decide what a "strategy of research" meant for them despite the scope of the research being very conceptual. A consensus emerged from these meetings that the main task must be to identify "strategic knowledge areas" that appear as bottlenecks from the exploration of the innovation field of low carbon emission mobility, and to propose means to acquire them through a group of projects to be conducted within the firm and on new partnerships to be built. All the participants of these meetings also agreed that the output definition was fuzzy and therefore a mutual decision was taken to rely on the project leader for proposing a more precise definition of the nature of outputs during the project. It was also stated that in the future another management meeting would be necessary to validate this. Consequently, it appeared to be **a first characteristic of creative projects: they have to design the nature of their deliverables.**

After a few methodological meetings with researchers, no unique method appeared as being adaptable for the creative project. Many tools seemed interesting to combine (Technological state-of the art, detailed analysis of contemporary uses of mobility and description of associated markets, design of scenarios of mobility, simulation of energy consumption, innovative design workshops). However, the necessity to structure the exploration of the field

step-by-step was underlined by the project leader who decides to use C-K modeling representation (Hatchuel and Weil, 2009) to keep track of the learning operated in the project. A second characteristic emerged here: **no clear toolbox was available to manage the learning in the creative project, i.e. to both gather heterogeneous knowledge on a fuzzy concept and structure interdependencies between them.**

To gather the most advanced knowledge of the firm on the topic, an initiative was held by the project leader to build and manage a cross-functional workgroup of about twenty experts from engineering, marketing, services and strategic corporate foresight. The workgroup was restricted to the work within Renault's premises in order to safeguard their intellectual property rights, but was cross-functional with the various departments of Renault in order to gather front-end knowledge and foresight from the various activities of the firm. They all had personal interests in exploring divergent innovative field, as all the departments at Renault were involved in EV mutations, but none of them was able to give a clear strategy of Research for technologies, services or business models that could in turn be valuable in low carbon emission mobility, and especially for long-range sustainable mobility. Thus, a third characteristic of the creative project appeared: **team members are motivated to work together, even if the target is highly unclear, as they share a "common unknown"**, i.e. they all need to learn new technologies, uses and business models of future mobility even if their potential uses of this knowledge in their current activities are disconnected.

Since the first meeting of the workgroup, it was clear that each of the participants were extremely keen and eager to delve further on the issue of long-range sustainable mobility, which was the common unknown, but they were looking for divergent topics of learning within the field. Nevertheless, the necessity to gather the skills of everyone for investigation of each potential topic was also clear. Thus, the workgroup decided to continuously clarify the benefit each member might take for the collaboration on the whole exploration through a dedicated effort on the formalization of value indicators on each topic investigated. As team members considered the topics of expected effective learning as potential value sources, this led us to our first proposition on creative project on "what is the value to manage in CP?": **P1 - the value resides in the exploration of the common unknown, it means the concepts (e.g. new ideas of products) and the evaluation criteria that are out of the dominant design scope and for which CP's team members are interested in**

4.2- How is the value to be managed and what are the appropriate indicators for CP? The building phase

From April to September 2011, the project involved the full workgroup in an intensive collective phase of analysis. Through three and half day workshops, they started with intensive knowledge sharing and learning. The main task was firstly to benchmark and describe the state of the art technologies, uses and business models (existing products, technologies, mobility and energy facilities, creative value chains, etc.) regarding low carbon emissions mobility inside or outside the automotive industry. Second, the team made an inventory of former and on-going projects managed by the firm that could contribute to new solutions for long-range sustainable technologies achievement, new uses or business models. At the same time, they built a systematic inventory of the relevant criteria to assess or compare the performance of those potential technologies, business models or services for low carbon mobility devices in order to develop and improve their dual value framework.

As the target of the project was really conceptual and large, the team members did not know what they were looking for in terms of completeness of the solutions they had to gather and the first three workshops were mainly focus on debating what a 2030 strategy on low carbon mobility meant for their firm. To do it, they investigated very different domains of knowledge such as technologies and services, markets and business models, contemporary uses and societal trends. Often, the creative exploration was very large and unfocused and the project leader had to reassure the members who felt lost. His arguments were many, but he mostly insisted on the fact that the modeling of the actual knowledge regarding low-carbon mobility was already a result for the firm and, individually, for each members of the workgroup. He claimed that this knowledge could be reused and shared for other activities. The team leader continuously repeated that the LCEM project was a creative one and that it was absolutely normal to diverge as the target was unclear. Similarly, the final selection of a few design paths was aiming to acquire the most generic knowledge, with potentially larger positive impacts on the learning than the development of the innovative concept that the led them. Three competitive targets emerged from this collective modeling works that differ on the strategic knowledge areas needed to reach them. The main design paths were: 1/ transporting more low carbon energy in a mobility device; 2/ gaining energy during the journey of the mobility device; 3/ supporting fluid inter-modality with electric vehicles. These design paths appeared as an efficient sub-division of the common unknown to maintain the collaboration between members even if the former learning phase made appeared some converging interests inside the group.

In a second collaborative phase, the workgroup was consequently divided in three sub-groups dedicated to the structuration of a research strategy on each competitive target across three others workshops. These workshops have been managed with a design methodology specifically developed for creative process (Hooge et al., 2012). Members involved themselves in a single or more sub-groups according to their interest and their availability. Relying on this structure of the CP's playing field, they conducted independent workshops in order to deepen these pathways and identify alternative creative design paths with the ones they identified as being the mainstream of the automotive industry. Alternatives had been identified through an intense debate and their levels of innovativeness were compared to the mainstream. This particular effort involved the sub-group in a systematic assessment of the dimensions of novelty a pathway could give by reference to technologies, their uses and business models included in the dominant design of the automotive industry.

Finally, they assessed the level of competitiveness of the firm on each potential design path and selected a few design paths to build the roadmap. The process observed was an efficient method developed by the team to tune the degree of breakthrough of each alternative pathway they explored. They were controlling the expansion process by managing the distance from the dominant design. This led us to our second proposal on "*how* the value is to be managed in CP and what are the appropriate indicators?

P2: the value is designed by managing the distance between the trajectories of the project and the dominant design.

Table 3 below synthesizes the main breakthrough of value operated during the LCEM project.

	LCEM Project
Innovation field	Low carbon Emissions mobility
Main dominant design	Focus on enlarging the on-board stock of electric energy
e.g. rules to break (mainstream)	• Expectations on Technology progress on Li-Ion battery for Electric vehicles • Automotive paradigm on business model (1 Owner, 1 Driven, 1 vehicle) • Autonomy expectations of drivers • Costs of infrastructure evolutions • Energy charging on the way and impacts on ageing the stocks • Definition of Mobile Stocks
e.g. new rules	• On-way charging • Fluidity of inter-modality • Re-insuring of drivers with low carbon emissions devices
e.g. next design paths	• Highway charging • Unlimited on-board stock of electric energy • Fast charging during a travel • Smart-grid payments

Table 3: the dominant design and examples of new design paths

4.3 For whom is the value to be managed in CP ? the building phase

The creative project supports the identification and involvement of stakeholders who benefit from the research. First, the beneficiaries of the creative project were individuals who committed themselves in workgroups: they had an active role in the choosing the path and they grasped the entire knowledge shared beyond those explicitly mentioned in the systematic modeling. After a few months of collaboration, the involvement of the initial workgroup members was still strong but spread further on the paths where they expected the most feedbacks for their own activity. Nevertheless, over a period the common sharing of the whole roadmap and the interactions across each exploration/research progressed greatly. Second, it is to be noted that the beneficiaries of the creative project are research managers who gained largely both because of the workgroup production and the emergent network they represented within the firm to pursue the investigation of the common unknown. Third and lastly, some parts of the second step of the CP had been opened to industrial partners from Energy and Highway industries, through three meetings with potential partners, in order to build a synergic roadmap for the research. These individuals appeared as a third type of beneficiaries as they could rely on the efforts of the value management operated by Renault to better formulate their approach of long-range sustainable mobility, which was also a field of innovation under investigation in their own firms. Finally, the project leader and the researcher gathered all data from the collective phase during the building phase from the end of September 2011 to January 2012. The aim of this phase was to consolidate the findings and thereby support the launch of the first research project proposed by the workgroup through an intensive communication for decision-makers. This identification of beneficiaries lead us to our third proposition:

P3: the value is beneficial to the emergence of new ecosystems made of innovative networks of stakeholders that share a common unknown regardless their firms' membership.

4.4 Impacts of the creative project on firm and ecosystem

At the last of the building phase, the project leader and research managers met in a final "definition" meeting to validate the nature of the outputs of the projects. To meet the expected outputs — identification of strategic knowledge and proposition of a research strategy through a coherent roadmap of research projects aiming to produce new knowledge on identified

bottlenecks, whether technical, economical or social —, the project leader proposed a robust modeling of the innovation field of long-range sustainable mobility, which took the formalization of a concept-knowledge map of the creative design paths explored by the workgroup. Beyond this output, three results were also validated as deliverables of the project: an in-depth modeling of individual mobility, regardless of the type of mobility, and associated societal expectations; a set of proposals of new business models and internal steps to reach them (projects, experimentations, cross-functional departments collaboration); and an identification of relevant partnerships outside the automotive industry. It had been underlined by the project leader that the large exploration of individual mobility had opened up unexpected valuable design paths according the knowledge acquired by the group on mobility services that did not include vehicles.

A few months after the end of the CP project (November 2012), several feedbacks could be given on the CP. First, the project has been positively valued within the Research Department: a second step of the creative project has been allocated until 2013 and the project leader has been given a wider scope of investigation on Electric Vehicle research. Moreover, the involvement of the team members ensured a large cross-fertilization of the knowledge acquired in the CP within the R&D department of the firm, especially through the on-going projects where the members were involved in parallel of the LCEM project. For example, the participation of combustion engine experts led to unexpected impacts on projects outside the scope of low carbon emission mobility. One year later, design paths are still under process with heterogeneous dynamics. During this period, the classical New Product Development process of the firm had absorbed some of them, while other design paths were redefined or appeared, requiring more investigation.

Table 4 below presents a synthesis of the key elements of CP.

Clarity of the target	Very low - Statement very conceptual and fuzzy – Shared interest to acquire knowledge (“common unknown”)
Diversity of knowledge (to investigate)	Technologies, groups of less efficient technologies, contemporary uses of mobility for individuals and professionals, emergent business models, new services, etc.
Diversity of the methods adopted for the creative exploration	State-of the art technology, detailed analysis of contemporary uses of mobility and description of associated markets, design of mobility scenarios, simulation of energy consumption, innovative design workshops
Means of identifying the paths to investigate	Knowledge sharing of information from technological, competitive and business intelligence
Means of exploration of the potential paths	Strategic analysis from workgroup members, availability of skilled resources and innovative partnerships
Means of assessment of the relevancy of identified design paths	Building of reference scenarios based on contemporary mobility uses and available mobile devices. Assessment of the innovativeness of the new design paths by comparison to actual references. Debates of workgroup's experts on the potential value for the firm and spontaneous support from other members of the research department (frequent presentation of potential concepts)
Diversity of paths explored	Broad divergence in the first workgroups. Final roadmap with three design paths very distinctive
Nature of the "official" results of the projects	Robust modelling of the innovation field, new representation of individual mobility, proposals of new business models and steps to reach them, identification of relevant partnerships
Identification of unexpected value, killed by traditional Value management process	The CP had demonstrated the relevancy to learn on some services that do not include vehicles
Generation of new projects	First steps of the roadmap on the three design paths became official Research projects.
Reuse of generated knowledge in other activities	Large cross-fertilization in the R&D department as team members were involved in few other on-going projects. Unexpected impacts on internal combustion engines projects.

Table 4: Characterization of the creative project

5. Discussion, limits and further research

5.1. Value Management in Creative Project vs in "Hard" and "Soft" Project

Our analysis shows that managing value in CP is a very different framework to the "hard" or "soft" VM (see Table 3).

First, the nature of value is different. The evaluation does not consist of measuring the financial results and the adherence to the cost/quality and delay, but rather to measure how the projects permit to gain sufficient knowledge on a common unknown. A successful CP is a project that constantly generates a large and various scopes of unknown concepts providing robust design capabilities to explore such an unknown. In order to better monitor the balance between these two dimensions, new indicators such as the number of design rules changed and the number of new design rules created may be developed.

Secondly, the ways to manage the value during the project is also different in the case of CP. Basically, in "soft" and "hard" projects, the people involved monitor and adjust their action in accordance to the final goal (most of time, this goal is the final product or services expected to be delivered). The successful "hard and soft" projects are those that minimize deviations by delivering what was originally defined and accepted by the customers and stakeholders. In CP, we also find this kind of deviation but in a specific way: *because the expected final state is unknown, actors/people do not adjust their process to a final state to reach but they adjust their process with the initial state to change.* More precisely, they guide their actions and monitor their advancement in comparison with the dominant design to struggle (Abernathy and Utterback, 1978; Utterback and Abernathy, 1975; Utterback, 1994).

A common hypothesis in innovation literature such as new product development is the uncertainty (i.e. lack of information) and the ambiguity (i.e. existence of different interpretations of a same piece of information) has to be reduced in order to provide clarity and efficiency. In CP, managing the value does not aim to reduce the uncertainties and ambiguities but, quite the contrary, *it implies to continuously invest the unknown by preserving areas of uncertainties and ambiguities during the project*. Uncertainties and ambiguities are no more considered as a risk to avoid but, on the contrary, project members should endeavor to invest it in a structured way. This key finding is quite similar with the recent research provided by (Brun and Saetre, 2009; Brun, 2011; Gutiérrez, 2011) who emphasize the importance of ambiguity and equivocality in the upstream stage of innovation.

During the CP, *a high level of ambiguities and uncertainties should be preserved: once the uncertainty and ambiguity are reduced on a certain dimension, new possibilities of creative must be opened in another dimension of the innovation field.* Practically speaking, such "undecidability" [1] state could be maintained by, on the one hand, generating and maintaining a high and various scope of concepts (new ideas…), and, on the other hand, generating and maintaining a high and various scope of design capabilities (knowledge, skills required for the implementation of the concepts...). Note that, disequilibrium between these two scopes would negatively lead to two usual symptoms of "creative" projects. In one hand, if the CP is managed in such way that it generates too many concepts compared to knowledge, the project would "stay in the air": the results of the CP would be too conceptual and impossible to make it real. On the other hand, if too much knowledge is generated compared to concept, the degree of creativity would progressively disappear: no disruptive innovation could be launched in the future and the people would stay in their "comfort" zone. Besides, the ambiguity does not necessarily induce a critical lack of clarity. Most of the time, it is very clear for the people that they do not have the same interpretations of a same concept but they just continue to "play with this ambiguity" to learn from each other. They do not unify their view but rather try to understand each person's interpretations in order to stimulate learning toward unfamiliar areas. Finally, the beneficiaries of CP are not only the customers and the stakeholders, but a CP has an impact for the new ecosystem too underlying the innovation field.

Table 5 below presents a comparison between the different VM models

[1] The authors emphasize the importance of undecidability in innovation. Undecidable propositions like new ideas cannot be rejected or accepted with respected to designer's knowledge. Such propositions are unknown and need to be explored.

		Hard VM	Soft VM	Expansive VM
Mission		Minimizing the risk of « non-value »	Clarifying the stakeholders value	Generating new valuable proposals
What is the value?		Commercial goods (product, service...)		Common Unknown - concepts and knowledge of an innovation field
Value *for whom?*		Value for the customers	Value extended to the stakeholders	Value extended to the ecosystem
How to manage the value?	process	The target value is identified at the outset Highly prescriptive Managing the conformity of the process with Job Plan Elimination of unknown at the outset	The target value emerges during the project Moderately prescriptive Managing the conformity of the process with stakeholders expectations Progressive elimination of unknown	Targets value are renewed during the project Poorly prescriptive Managing derivation with the initial dominant rules Generation and structuring of the unknown
	social	Stable and cooperative team (clear division of labor)	Evolutionary and collaborative team	Heterogeneous and co-creative team
	Process indicators	VAN, QCD		- number and variety of dominant design rules broken - number and variety of new design rules created
	Social indicators	Satisfaction of the final customer at the lowest cost	Satisfaction of the greater number of stakeholders for a same value	Satisfaction of heterogeneous stakeholders regarding multiple values
	Main tools	Job Plan, Functional approach, Quality Function DCPloyment, Cost Modeling	Stakeholders analysis, conflict resolution techniques, Group decision support system, SMART	Concept-Knowledge tools
Type of rationality		Expected utility under risk	Subjective expected utility under uncertainty	Rational choice under unknown

Table 5: Main differences between CP and Hard/Soft VM

6.2. Limits and perspectives for further research

This research is supported by a case-study and further research is required to improve the generalization of the findings. Particularly, the industrial sectors involved in this research (automotive, energy) are both old and mature. Consequently, the existing products and services developed in these industries are supported by old and stable dominant designs. Further research could focus on the management of value in creative projects in emergent industrial sectors with no dominant design (creative industries, biotechnology industries…). Furthermore, this research proposes recommendations for managing value in a creative process. Especially, new set of indicators based on the notion of design rules are introduced. We emphasize the fact that the value of creative process may be approached by identifying the design rules that are broken and new design rules that are created. More studies are needed to validate such a proposal; in particular, more knowledge is required to measure what is the optimal ratio that is to be reached for achieving successful creative projects. Besides, the determination process and the evolution of the design rules in these teams must be investigated further: where do the new design rules come from? How can one identify the old ones? How teams do cope for managing multiple and deviant design rules?

This research is to link with a recent movement in the academy that aims to rethink the project management practices in situation of creative and explorative situations. This research opens also new questions regarding the decision making process in situation of unknown. Many theories and algorithms exist for decision making under risk (expected value…) or uncertainty (Savage's minmax regret, Laplace criteria…), very important contributions are wanted for control and decision making theory in the unknown (Miller, 2007).

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