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## TITLE

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### Abstract en français:

Cet article vise à mettre en lumière le rôle des principes de conception dans le processus d'alignement des partenaires au cours de la phase de structuration d'un écosystème d'innovation. L'émergence et la gestion des écosystèmes font actuellement l'objet d'un examen minutieux, car tous les grands défis économiques et sociétaux impliquent des solutions d'innovation au niveau de l'écosystème. Comme les structures, les processus, les normes technologiques, le système de demande et d'offre, les réglementations ne sont pas définis, la phase d'émergence exige des partenaires qu'ils explorent collectivement les inconnues. La littérature fournit des éléments sur les facteurs d'émergence de l'écosystème (Hannah & Eisenhardt, 2018), et sur la pertinence de l'alignement des partenaires vers une telle émergence (Adner, 2017). La perspective de la conception contribue à identifier des règles (LeMasson et al. 2012) et des principes (Olilla et Ystrom 2016) permettant aux acteurs d'effectuer une exploration collective, mais la manière dont les principes de conception peuvent favoriser le processus d'alignement des acteurs n'est pas claire.

La recherche a été menée en appliquant la méthodologie inductive d'études de cas multiples et le protocole de recherche-action sur trois initiatives, toutes contribuant à la structuration de l'écosystème de la mobilité autonome et connectée. Les données collectées par la participation à des réunions et la réalisation d'entretiens semi-structurés ont été analysées par codage.

Les principaux résultats sont la définition du chemin d'alignement des partenaires dans le contexte de la structuration de l'écosystème ainsi que la confirmation des principes de conception dans un tel processus stratégique. Nous contribuons à la caractérisation des principes de conception en identifiant les conditions spécifiques de leur application effective. En outre, nous avons identifié un sixième principe de conception lié au rôle de la gestion des artefacts dans la collaboration vers de nouveaux arrangements et l'exploration des interdépendances.

Cette recherche contribue à la modélisation de la structuration de l'écosystème à l'intersection des frontières sectorielles, avec des implications sur les frontières des organisations.

Mots clé: conception, artefacts, écosystème, interdépendances

## 1. ABSTRACT

This article aims at shedding light on the role of design principles in the process of alignment of partners during the structuring phase of an innovation ecosystem. Ecosystem emergence and management is under current scrutiny as all major economic and societal challenges involve innovation solutions at ecosystem level. As structures, processes, technology standards, demand and offer system, regulations are not defined, the selected phase requires partners to collectively explore the unknowns. Literatures provides elements on ecosystem emergence factors (Hannah & Eisenhardt, 2018), and on partners' alignment relevance toward such emergence (Adner, 2017). Design perspective contributes to identify rules (LeMasson *et al.* 2012) and principles (Olilla and Ystrom 2016) for actors to perform collective exploration, but it is not clear how design principles can foster the process toward the alignment of actors.

Research was conducted applying the inductive multiple case study methodology, and action research protocol on three initiatives, all contributing to the structuring of the autonomous connected mobility ecosystem. Data collected through the participation to meetings, and the realization of semi-structured interviews, were analyzed through coding.

Main results are the definition of the path of alignment of partners in the context of ecosystem structuring as well as the confirmation of design principles in such strategic process. We contribute to the characterisation of the design principles by identifying specific conditions for the effective application of the them. Furthermore, we identified a sixth design principle related to the role of artefacts management in collaboration toward new arrangements and interdependencies exploration.

This research is relevant to the conference as it is focused on contributing to the modellization of ecosystem structuring at the intersection of sectors boundaries, with implications on the boundaries of organizations. Autonomous connected mobility is a field of innovation situated at the intersections of sectors, with high economical and societal values.

## 2. LITERATURE REVIEW AND RESEARCH QUESTION

The complexity of the current economic and societal challenges has increased the interest of academics and practitioners in ecosystem management. Connected healthcare, smart mobility, durable energy management, they are all examples of innovation challenges that require several heterogeneous actors to collaborate for the definition of the value proposition at the intersection of different sectors. As relationships among participants are multi-faced objects dealing with exploration of unknown, organizations struggle to identify their path toward nascent ecosystem structuring aimed at sustainable positioning.

Preliminary elements on the challenges of the birth phase of ecosystems have been provided since the early stage of studies in business ecosystems (Moore 1993). Ecosystem emergence factors have been outlined (Hannah & Eisenhardt, 2018), as well as the partners' alignment relevance toward such emergence (Adner, 2017) but still not much is known about this phase (Jacobides 2018). Recent studies highlight that ecosystem emergence is a process characterized by specific dynamics among agents, such as the balance between control and autonomy

(Hanninen *et al.* 2020), the distribution of innovation agency for structure and procedures definition (Hurni *et al.* 2020), the exchange of knowledge in temporary loci of gatherings for platform structuring (Fang *et al.* 2021), the development of shared intentionality enabled by knowledge sharing (Taillard *et al.* 2016), and the development of trust (Gelhaar and Otto 2020).

The requisite of sense-making process for partners' engagement into ecosystems (Autio and Levie, 2017) resulting in regulative, normative and cognitive structures (Llewellyn, D. W. T., and Erkkö, A. 2015) has been elucidated, as well as the collaborative actions structuring the design of platforms (Le Masson *et al.*, 2011).

Considering the novelty of agents' interactions dynamics and of the attributes that must result from the collaborative exploration of unknowns in ecosystem structuring, the perspective of design approach to innovation management and strategy is appropriate to search for further elements on this process.

Design theories and methodologies allow knowledge management toward building partners' common purpose (Gillier *et al.*, 2012), shared concern and original solutions in unknown exploration (Pluchinotta *et al.*, 2019). When societal challenges are addressed by research, collaborative innovation organization is related to five design principles (Olilla and Ystrom, 2016), as well as to peer to peer collaboration and constitution of a permanent strategic body (Elmqvist *et al.* 2016).

Collective exploration of the unknowns might drive toward new design regimes when design capacities become collective, and the exploration is performed under regulative, normative and cognitive unlocking rules (LeMasson *et al.* 2012). Unlocking rules generates a locus of reciprocal inspiration, the "*college of unknown*", in which the network of interactions among actors enabling the emergence of collective design capacity. In case of important societal challenges, the collaborative exploration of innovation at cluster level has been framed in term of degree of staleness, even in presence of existing markets, and such staleness has been linked to cognitive frameworks (Agogué *et al.* 2012). But although a model for characterizing this innovation as orphan has been provided, no indication of tools or methodologies were provided for managing the unlocking process.

How design capacities become collective, and how actors can align for collaborate in this design space?

In collaborative radical innovation partnerships, there are obstacles to common purpose definition, such as misalignments in desired individual projects, business and interests. Knowledge domains generate a turning point from which actors share internal information and build common ground to move toward shared needs (Gillier *et al.* 2012). But sharing internal information needs to be fostered. By viewing the collaborative innovation from the design perspective, the organization of the joint action should bring equal presence, creativity through diversity and of partners who should associate their action to a higher purpose in order to be able to take a distance from organizational routines, and finally collaborate (Olilla and Ystrom 2016). Such higher purpose might be also defined as a shared concern, deriving from the problem frames alignment among actors. As stated by Pluchinotta *et al.* (2019) in the case of policy design, the willingness to cooperate among heterogeneous stakeholders emerges in the convergence to a shared concern enabled by problem frames alignment. Such alignment derives from the acceptance of knowledge on non-traditional solution, as in the case of complex and wicked issues such as environment policy design. This problem frames' alignment solves the

stakeholders' perception on the policy highlighted as an obstacle to the reduction of conflicts generated by existing policies, and it paved the road for values restructuring. In the case of transformational networks, willingness to engage in collective knowledge mining and conceptualizing is anchored in peers' conversations based on shared commitments to action and learn (Ystrom *et al.* 2019).

Although several elements on the process of collaboration for collective exploration of unknown have been provided, still, there is no clear recommendations on how actors achieve collaboration in such exploration and contribute to the generation of an ecosystem under the following conditions:

- Technologies are emerging
- Value proposition cannot be achieved by a single actor, but must involve heterogeneous actors, including competitors and organizations from different sectors
- Actors have to move away from the dominant design
- Demand is not stable as potential users do not know what they want yet
- The goal of the collaborative exploration is the deployment of a product or service to be jointly achieved (performance of the exploration is not measurable only from a technology perspective)
- Attributes of the solution to be co-created for successful deployment in term of users' adoption, must be applied at international level,
- Regulations needed for the deployment of the solution are not stable

Literature elucidates the need of a specific space of agency in which knowledge can be shared in order to align individual projects and problem frames, the detailed path for creation of shared intentions and purpose seems related to conversations that should drive the coherence of perceptions of the situation among actors. Design perspective applies to this context of collective exploration of the unknown, but little knowledge is available on how design impacts on partners' alignment during the phase of ecosystem emergence.

We formulate the following hypothesis:

H1: design principles apply to the collective exploration of the unknown in the ecosystem emergence context. Principles impact partners' alignment process in such exploration, and this impact might be relevant to conditions' setting for nascent ecosystem structuring.

H2: the conversations allowing the collective agency are performed through artefacts manipulation, which contribute to the alignment of individual projects and problem frames.

In the next chapter we will present the methodology and the cases selected for this research project.

### 3. METHODOLOGY & CASE STUDY

Based on the context to observe and the dynamic topics to be investigated, we chose the inductive multiple case study methodology (Eisenhardt, 1989; Yin, 1994), and we selected three complementary innovation initiatives in order to shed lights on a systemic topic and to add validity to the results. Data collection included data through the realization of semi-structured interviews, the researcher participation to the cases, under the protocole of action research and through the participation to related conferences and symposia.

The autonomous connected mobility was selected as a field of research as it complies with the characteristics of emerging ecosystems elucidated by Hannah and Eisenhardt (2018).

The initiatives were selected as they all contribute to the progressive structuring of an innovation ecosystem, the autonomous connected mobility at European level.

The first case, developed by a consortium formed by four automotive manufacturers (OEMs), one energy supplier, a service operator and one academic institution (we were part of it), aimed at the deployment of 200 EV charging stations in two years along a national highways network. The second case, developed in three years by a consortium formed by three carmakers, two service providers, two private IT and cloud operators and one academic institution, aimed at creation of a marketplace to monetize data extracted from connected cars. The third case, developed by one carmaker, in collaboration with a Tier1 supplier and several industrial public and academic partners, aimed at the creation of a shared vision of the autonomous mobility, as a first step toward profitable services for autonomous driving integration into local urban environment.

We participated as active partner in the role of value network and business model designer for a total of 3,5 years, attending consortia meetings for over 460 hours. We performed 43 semi-structured interviews with partners of the consortia and stakeholders.

Relying on these data, we followed a qualitative process of analysis through coding and created (and recreating dynamically) a narrative of how things (Dumez and Jeunemaitre, 2006)– organizations, people, opinions, objects, etc. – evolve overtime and why they evolve in this way (Van de Ven, 1992). Tables and charts (Miles and Huberman, 1994) were created in order to detect paradigms and compare the cases on such base.

The evolutions of the actors were analyzed on the base of three characterizations of the exploration situation and three dimensions of participants interaction with the situation:

- Characterization: systemic-ness of the design space, disruptiveness of value proposition and platform level
- Dimensions: alignment, knowledge management, project management

The findings of the above analysis process are presented in the next chapter.

#### 4. FINDINGS&DISCUSSION

From the data analysis, it appears that partners' action toward alignment for collective exploration when offer and demand systems are not stable, is a rough journey.

Partners with different backgrounds and identities embarked in innovation initiatives with top-down decision attitude and a predefined representations of the challenge and of the solution to be performed as a simple sum of actors' inputs, as stated by partners at the very first meeting of the initiative: "*We tried everything already and no business model worked.*" Telemetry services manager, OEM, "*We will be interested only in the data that generate benefic effect in the magnitude of the service purposes, otherwise data should stay with the OEMs, because there is no shared business case*" Business Development Manager, Service Provider.

Such predefined representations generated *qui pro quo* while partners had to move toward definition on problem to be solved, as the problem boundaries were not shared among them. The concept underlying the problem-solving stage had to be redefined, and debates during the meetings became fierce. From regularly set official meetings in presence, in which in the time frame given one actor was leading the debate, sub-groups formed for giving space to more

specific discussions in which the actors involved had coherent intentions. Partners started to deal with open ended questions which threaten the established action path. From a technology standards perspective, partners discovered during the concept redefinition that technology standards available for data capturing, processing and transferring were not adapted for performances associated to the value proposition to be co-created, as well as specific regulations (i.e. privacy rules for personal data use). As stated by one OEM representative: *“There is incoherence in the project...It means that we will have to say that some technological choices done for the prototype are not the more adequate ones for the scalability of the platform originated from the concept.”*

The un-harmonized approach on measurement for instance, resulted in a pessimist attitude of Service Providers, who were negatively impacted by it and started to express doubts on the pertinence of their participation to the project, if no meaningful test can be conducted during the project duration. Strong declaration as the above pushed other OEMs to consider the proposal of a different standard and to work closely with proactive Service Providers.

While exploring the answers to such questions, partners realized that there will be unavoidable deviations from the process and the performances initially associated with the initiative.

Such deviations needed to be managed within organizations and often challenged established internal process or routines. Nevertheless, the adjustment of process and performance was mandatory for the progressive exploration of value proposition and technology standards as solution to the redefined problem. Such readjustment implied direct actions from partners in establishing a new legitimacy within their organization and ignite the opportunity of organizational changes as condition for the systemic solution to happen.

Partners progressively shifted toward design attitude, as meaningful co-defined and co-delivered value proposition needs problem redefinition. The discussion on open questions was supported by the design and use of artefacts to create a space for individual representation changing, as the lack of tools to explore scenario when technology standards are still undefined. For instance, when the degree of platform openness was still an open debate among partners, the lack of tools to allow users to understand data value appeared: *“We need tools to help us to combine the sand in different ways”* (Business Development Manager, Service Provider).

The evolution of representations allowed the alignment toward the redefinition of concept at the base of the value proposition and the new value network to be designed and structured.

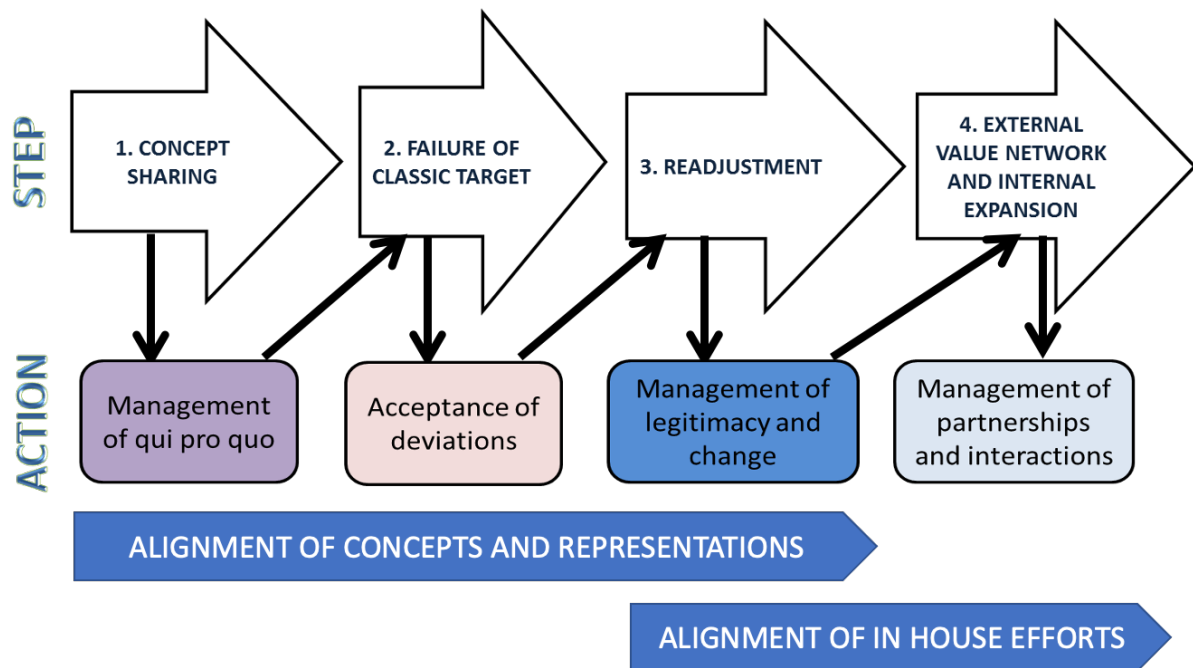
Even without a shared higher purpose, actors were united by the common challenge of shifting from problem solving to problem finding, which involves mutual understanding and unprecedented experienced level of information sharing as mentioned by a partner discovering the real width of the collaboration needed: *“It is incredible: we cannot move forward contract negotiation on six commercial sites, if we do not involve also their Sustainable Development and Oil Directions.”*(Project Manager, Utility Provider).

Diversity of perspectives and competences was initially an obstacle to such understanding and sharing process. It became effective when partners realized that the value proposition was not achievable without embracing the diversity, and especially without direct intermediation with users and policy makers. The value of the results in term of new knowledge and new technical standards was recognized in the applicability beyond the initiative, toward the progressive structuring of the ecosystem (*“The trans-boundaries interoperability to be applied in future potential projects as a follow up of CorriDoor will help us to define where to position more charging stations in France”* Program Manager, Utility Provider, *“I see now the strategic interest of building a bridge with Service Provider, within Automat scope or not”* R&D manager OEM.)

The extent and the value of such diversity are discovered during the exploration.

The steps of partners' alignment toward definition of the value proposition and structuration of the partnership for the ecosystem to be are visualized below:

Fig 1: Partners' Alignment process during exploration



The modelling of the alignment path in this exploration context allowed the analysis of the applicability of design principles.

The first hypothesis we formulated is: “design principles apply to the collective exploration of the unknown in the ecosystem emergence context. Principles impact partners' alignment process in such exploration, and this impact might be relevant to conditions' setting for nascent ecosystem structuring.”

From the above analysis of the cases, we can confirm that the five design principles identified in literature (Olilla&Ystrom, 2016) apply to this collaborative exploration of the unknown. Since the very beginning of the initiatives, actors attended physical meetings, but the balance in interaction was a challenge per se, due to individual attitude and roles in the initiatives. The emergence of qui pro quo characterized the first development of interactions, but delayed the “make-it-happen” moment for actions.

Actors' diversity was a starting condition of initiatives, and it even increased over time, but actors struggled to find constructive path to transform diversity in a knowledge asset.



Individual and organizational cultures played a role in the actors' attitude to embrace the culture of juxtaposition requested by such exploration, and the duration of the initiatives is not coherent with the time needed for this cultural transition.

Furthermore, we observed that participants were able to put a distance from organizational habits, when they realized there was no other option, and that through the evolution of their representation, they acknowledged that the risk of proposing internally another way was actually coupled with the discovery of a new value opportunity. The representation evolution through the interactions with the other actors in the concept redefinition phase allowed this process of sensemaking, and the evolution of individual intention within an organizational frame.

As far as the active role of participants, we found that conceptualization and symbol construction need to be guided in order to be effective, as usually participants are not skilled to do such tasks and do not move easily away from the cognitive space in which they built their representations.

In order to result in collaboration effective establishment, there are specific conditions to be considered. The conditions for principles' application are detailed in the frame below:

Frame 1: Conditions of application for design principles

<i>Olilla's Design principles</i>	<i>Finding</i>	<i>Conditions</i>
1. Physical presence for interaction	Physical presence can be the occasion of reinforcing unidirectional messages from most influential actor. Information to be discovered and treated is more abundant than forecasted	Loops involving sub-groups of actors should be fostered in order to move forward in collective sense-making of the unknown.
2. Diversity of partners	The value and the extension of the diversity needed toward value proposition definition is discovered through the process	Partners' participation to exploration should be flexibly framed.
3. Multiple identities of participants for culture of juxtaposition	The level of ambiguity of this culture needs time and instruments to be accepted and useful, as one culture is predominant in each participant.	Multiple identity doesn't guarantee knowledge sharing if this sharing is not coherent with dominant culture. Juxtaposition is a pre-condition for a deeper interaction to happen
4. Common purpose	Disruption of organizational habits happens without or before the complete awareness of a common purpose, as individuals evolve in their intentions. Before the common purpose, actors identify new areas of value that ignite the willingness to collaborate.	The exploration phase setting shall address the evolution of individual intentions. The goal of joint deployment contributes to the process of discovering the common purpose during exploration.
5. Active role through conceptualization and symbol construction	Actors might change representations of their actions, and through this change they take collaborative actions	Conceptualization and symbol construction shall be guided in order to have actors to interact among different cultural spaces.

From the data analysis, it appears also that at the beginning of the initiative, partners are not aware that they will collectively face the unknown. They ignore that they are embarking in such exploration journey, as they will have to co-create by collective action, a new object or service, that was not completely predictable at the beginning and is the result of the combination of partners' fields of knowledge and external stakeholders' fields of knowledge.

One of the obstacles of such innovation ecosystem initiatives is to solve the « knowledge distance » among partners, distance characterized also by differences in terms of culture, business and time perspective. Through the manipulation of some artefacts by sub-groups addressing a specific subject, partners progressively discovered their initial intentions were not adequate (Business Development Director, Service Provider (“*why don't we use the meetings to revisit the timeline of the project, to validate if it makes sense, and to verify if we learnt something?*”). They progressively authorize themselves to formulate different hypothesis of masterplan interpretation and less formal meeting use. Nevertheless, partners are not aware of the role of knowledge distance as obstacle for them to project themselves toward on a common desirable business future, to be used as a valuable argument for the alignment of in-house effort toward initiative completion.

Artefacts such as design and management tools, played a significant role in the evolution of the representations actors have about their actions. Through artefacts manipulation, the progressive alignment of partners representations as new concepts emerged from knowledge sharing and creation.

We noted the progressive participants' intention convergence as interest in the project evolved for some partners, as stated by one player: “*engagement is such a project comes from individual but shared enthusiasm and by the target vision toward a big ambition*” Tier 1 Supplier. Influence of partners evolved, toward building consensus on acceptance of compromises at organizational level in a progressively discovered knowledge and design space. In this space, partners were able to represent the deliverable as an object of convergence of technological solutions to match users' needs and an object of business intentions convergence for several actors. New arrangements and interdependencies among stakeholders (evolution of role in the initiative, extension of partnerships in other sectors) are explored, and when consolidated, become a part of the new ecosystem.

As per the above elements, we can confirm the second hypothesis: “the conversations allowing the collective agency are performed through artefacts manipulation, which contribute to the alignment of individual projects and problem frames”.

Artefacts management allows the dynamics between individual and collective agency in structuring ecosystems; in order to reach intentionality sharing, we need the mediation of artefacts, as words' role elucidated by Taillard *et al.* (2016) is not sufficient. Initiatives start with symbols, systems, artefacts, procedures legitimized a priori, but that are related to languages, functions, organizational cultures not adequate for the exploration to be performed. By creating and manipulating specific artefacts, actors move away from their routines. We can create an intention-sharing zone among part of the actors in which actors define practices. Such practices result in intention interdependent-ness, as step toward the structure of the emergent ecosystem.

The above elements suggest the introduction of a sixth design principle: Artefacts are media with dynamic identities, and by the design and management of such media, arrangements and interdependencies toward partner's alignment can be found.

Further research shall be performed to test the validity of this principle in other situations of ecosystem emergence.

## 5. CONCLUSIONS

There are two level of contribution to scholarship. Firstly, the path of alignment of partners in the context of ecosystem structuring is described, contributing to the literature beyond the identification of the alignment structure. The design of such path impacts the technology standards progressive establishment. The active role of public authorities is also elucidated as needed for the value proposition structuration. Secondly, the contribution is relevant to the role of design in such strategic process. We contribute to the characterisation and the extension of the design principles, as we set specific conditions for the five principles identified by Ollila. Furthermore, we identified a sixth design principle related to the role of artefacts management in collaboration toward new arrangements and interdependencies exploration.

We contribute to practice by shedding light on the steps and tools enabling a process which challenges the way organizations manage innovation and which is source of strategic and societal value.

We elucidated the reason and the path for organisations to overcome the structural negative evaluation of performance of highly uncertain innovation initiatives, as they are part of a lineage which value must be considered at different levels and at different time horizons.

Furthermore, we provide indications on how to deploy artefacts in order to efficiently manage such alignment process and arrangements discovery.

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