Projects as the enablers of ecosystem's emergence: The case of the connected autonomous mobility

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Titre : Les projets comme activateurs de l’émergence d’un écosystème. Le cas de la mobilité connectée et autonome.

Mots clés : innovation systémique disruptive, écosystème, exploration, artefacts, management stratégique

La thèse porte sur les formes de management pertinentes de projets d’innovation à forte composante systémique, disruptive et digitale, et qui contribuent à la structuration d’un écosystème. En effet, ces types d’innovation deviennent historiquement de plus en plus nombreuses étant donnée la connexion croissante des objets/services/entreprises/pouvoirs publics et les nouvelles possibilités de business croisés qui en résultent.
Les informations fournies par la littérature existante permettent aux gestionnaires de prendre des décisions stratégiques lorsque les règles du jeu sont définies par des acteurs connus, mais pas lorsque les acteurs et l'environnement sont progressivement définis. De nos jours, les responsables d'institutions privées et publiques doivent s'aligner sur des conditions internes et externes variables, des perspectives temporelles et un système de demande mal défini. Ils manquent de conseils sur la façon de procéder. Les questions de recherche émergeant d’enquêtes empiriques et théoriques sont les suivantes:
1. Comment un projet d’écosystème peut-il être géré? Existe-t-il un schéma spécifique et quelles sont les variables du pilotage de projet?
2. Quels sont les processus de pilotage les plus stratégiques pour la sélection de projets d'innovation liés à la structuration des écosystèmes? Quelles sont les variables organisationnelles et les variables médiatrices de la structuration écosystémique?
3. Quels sont les artefacts de gestion les plus adéquats pour soutenir le processus d'exploration dans le contexte d'un projet d'écosystème?
Afin d’étudier les dynamiques à l’œuvre, et d’instrumenter leur pilotage, le travail de recherche porte sur le cas de la mobilité connectée, observée par la participation à trois projets, suivant les usages qui se définissent sous l’impulsion des OEMs, et sous les initiatives des usagers (véhicule autonome, connecté, électrique, partagé). Les projets choisis portent sur la diffusion de l’infrastructure de recharge rapide du véhicule électrique, la création d’un prototype de marketplace pour les données collectées par les véhicules, et le développement de services autour du véhicule autonome. Tous constituent un terrain particulièrement perturbé par le trend de connexion, obligeant à une reconfiguration des acteurs, de leurs politiques partenariales, leur business model (ex : Uber, Google Car…). D’où le besoin actuel de réactualisation des outils et des théories existantes en management de l’innovation.
L’analyse des données collectées permets de répondre aux questions posées. Suite à l’Identification des challenges spécifiques aux projets d’innovation systémique et disruptive, nous avons développé un cadre d’analyse et d’action intégrant les trois logiques théoriques sous-jacentes (platform leadership / systemic innovation, disruptive innovation / design driven innovation, digital business model). Nous avons identifié et caractérise une typologie de projet, le Proto-ecosystem project, qui permet aux acteurs la création de connaissances, compétences et liens qui participent à la structuration d’un écosystème. Nous avons identifié le processus-type par étape finalise’ à l’alignement des partenaires des projets observés et les artefacts plus performants dans cette démarche. Nous avons indiqué les limitations de cette recherche et les possibles évolutions pour l’avenir.

Title : Projects as the enablers of ecosystem's emergence: the case of the connected autonomous mobility

Keywords : systemic disruptive innovation, ecosystem, exploration, artefacts, strategic management

The thesis deals with the relevant forms of management of innovation projects with a strong systemic, disruptive and digital component, which contribute to the structuring of an ecosystem. Indeed, these types of innovation are becoming more and more numerous given the growing connection of objects / services / companies / public authorities and the resulting new cross-business opportunities.

The insights provided by existing literature enable managers to perform strategic decision making when rules of the game are set among known actors, but not when the actors and the environment are progressively defined. Nowadays, managers from private and public institutions need to get aligned with variable internal, external conditions, time perspectives, and ill-defined demand system; they miss guidance on how proceeding with it. The research questions emerging from empirical and theoretical investigations are the following:

1. How can an ecosystem project be managed? Is there a specific pattern, and which are the variables of project steering?
2. Which are the most strategically performing steering processes for the selection of innovation projects related to ecosystem structuring? Which are the organizational variables and the mediating variables toward eco-systemic structuring?
3. Which are the more adequate management artefacts to support the exploration process in a context of ecosystem project?

In order to study the dynamics at work, and to provide instruments for their management, the research work focuses on the case of connected mobility, observed through the participation in three projects, according to the uses defined by the impetus of OEMs, and under the initiatives of users (autonomous vehicle, connected, electric, shared). The projects chosen concern the diffusion of the fast charging infrastructure of the electric vehicle, the creation of a prototype marketplace for the data collected by the vehicles, and the development of services enabled by the autonomous vehicle. All of them constitute a terrain particularly disrupted by the trend of connection, forcing a reconfiguration of actors, their partnership policies, their business models (ex: Uber, Google Car ...). Hence the current need to update existing tools and theories in innovation management. The analysis of the data collected provides elements to answer the research questions. Following the identification of management challenges specific to systemic and disruptive innovation projects, we have developed a framework of analysis and action integrating the three underlying theoretical logic (platform leadership / systemic innovation, disruptive innovation / design driven innovation, digital business model). We have identified and characterized a project typology, the Proto-ecosystem project, which enables stakeholders to create the knowledge, skills and connections that contribute to the structuring of an ecosystem. We have identified the typical process by stage finalized to the alignment of the partners of the observed projects and the more efficient artifacts in this alignment process. We have indicated the limitations of this research and the possible future evolutions.

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The path to the final document that you have in your hands had been nurtured by regular, constructive exchanges with the jury members, who allowed me to progress. I would like to express my gratitude for having contributed to this path with the inputs, the feedback on the mid-term defense and the reading.

The research field was accessible because several partners had been willing to embark in such innovation projects and they welcomed my inquiry and questions. I would like to warmly thank all of them, and especially Jens, Johannes, Lomig, Guillaume, Cecile, Daniel, Victor and Olivier.

An important contribution of the intellectual progression I made during the data collection analysis and thesis writing came from the interaction with the community of peers. I would like to thank you the members of SES laboratory, Telecom ParisTech, who have, from far or close, contributed to this research work. Thank you to for having given the context and the conditions for the completion of the research. I would like to express my gratitude to the members of the CRG, Ecole Polytechnique, who welcomed me as a teammate and allowed me to integrate my reflection with significant inputs and opportunities of learning. A special mention of gratitude goes to Carola, with whom I shared the up and downs of a peculiar choice, the transition from a manager life to an academic one. And it is not over yet!

The academic journey this PhD is part of was inspired and it has been nourished by the exchanges with Adam Greenfield, whom I thank for provoking critical reflections on concepts and reframing of contexts.

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INSPIRATIONS

"*To think, draw, design and build cars is not only an enthralling mental process. Nor is it simply a business choice. It is also and above all a great social responsibility*."
Andrea Pininfarina

To Livia and Alessandro

GENERAL PLANNING

1. INTRODUCTION

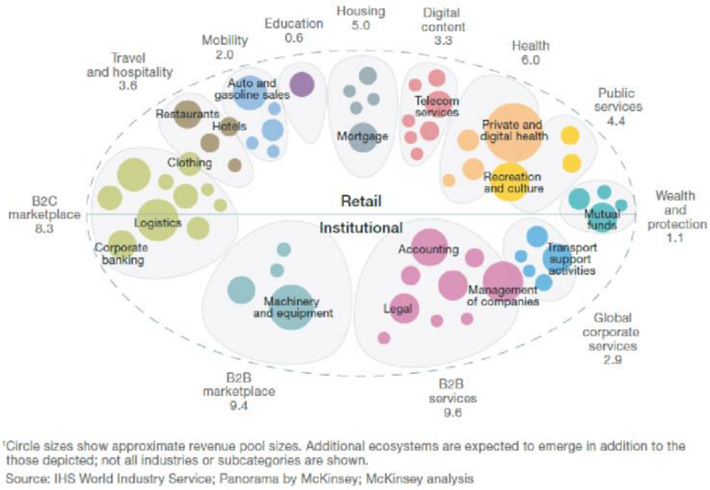
1.1 Empirical context

1.1.1 Ecosystems as the new locus of innovation

It has been widely described that industries have been disrupted by platformization, and that sectors' boundaries are becoming more blurred due to the ecosystem-based dynamic of resource flows (energy, data…). This is partly because of the current digitization trend. For example, current innovation topics on smart mobility, smart cities and smart homes, are driven by digital technologies; such topics call into question the strategy and innovation management literature, as they need several heterogeneous actors to collaborate for the definition of a value proposition and value network at the boundary of several sectors.

Even if "open innovation"(Chesbrough et al., 2006), "ecosystem"(Adner, 2006; Adner and Kapoor, 2010; Iansiti and Levien, 2004a) and "platform" thinking (Cusumano and Gawer, 2002; Gawer, 2009; Gawer and Cusumano, 2014, 2008) have dramatically improved in the past decade, we are still far from giving concrete guidance to projects trying to build "smart cities" or "integrated healthcare". These projects require numerous and heterogeneous players to co-invest upfront in a common research project to build a seamless customer experience, to hybridize and connect products & services, and to demonstrate short-term and long-term business viability for all contributors who join the initiative. A general view of effects of digitalization on industries borders is proposed by McKinsey and it results in the emergence of twelve large ecosystems, as shown in the figure:

Figure 1 Ecosystem Illustration- estimated total sales in 2025 USD trillion



Source: (Atluri et al., 2017)

Ecosystems' characteristics also depend on local regulations, cultural habits and sensitivities; relationships among participants in digital ecosystems have been defined as commercial and contractual (Atluri et al., 2017), but the observation of cases in different industries might suggest that relationships are multi-faced objects beyond commercial and contractual characterizations.

Given the above picture of boundaries blurring, organizations struggle to identify the best performing position in a nascent ecosystem, while also capturing value from cross-sector opportunities. It appears henceforth that for an effective strategy toward competition around a digital technological platform, the strategic role of innovation is higher than ever.
This impact of sectors blurring and the ecosystem-ization of industries on business evolution and complexity, has been recognized in several sectors, such as home appliances, healthcare and luxury.

Even established companies with a steady sales progression such as Hermes, recognized that their hitherto successful business model based on creativity, control of know-how and communication in order to build exclusivity around widely available products, is put under threat. Organic growth and margin expansion are impacted by digitalization in many ways. On one hand, digitalization disruption is changing life-styles, modifying the shopping experience, but on the other hand, it is also providing opportunities from omni-channel connections (Kapferer, 2014). The value chain and consequently the traditional business model need to evolve accordingly.
Pharmaceutical companies are leveraging digital technologies to provide a more efficient, cost-effective, and patient-centered healthcare. The objective is to make healthcare more affordable and to shift from volume-based to value-based and pay-for-performance business models. Reimbursements will be increasingly based on the quality of integrated care provided, not just the number and type of procedures executed.

In order to enable such an evolution of the healthcare service, incumbent and newcomers are progressively structuring an ecosystem based on a data platform, as shown in the figure below:

Figure 2 Healthcare data platform race

Source:(Cascadia Capital LLC, 2015)

The implementation of such platformization is critical as downsides might arise in the adoption of users of different groups. The case of the medical software upgrade with EPIC highlights the lack of consideration of the experience of key users (the doctors) and of the human relationship with complexity (Gawande, 2018).

The degree of systemic-ness and disruptive-ness in innovation projects increases dramatically in every sector, but with a higher rate where the resources to be shared represent a huge investment for users, or where digitalization allows the increased sharing of such resources and the social impact of such sharing is high for individuals and for the communities. For example, smart cities face new urban contests to support a spatially enabled society through ubiquitous computing and digital technology (Roche et al., 2012).

Smart cities are not the output of one actor's isolated action, but a value proposition of the territory given by different actors with different DNAs (private-public), with different technology road maps and different time lines.

The smart cities trend involves the transformation of the governance of cities, which is heavily impacted by digital and network technology, as described by John Tolva, previous Chief Technological Officer of the city of Chicago:" *the process of running a city is easier by making the management public through open data….and by outfitting city with sensors to make it smarter…but cities were not built with a full network system in mind*". Network and data management becomes an instrument for policy making. Furthermore, the definition of value brought by a city to its inhabitants becomes increasingly articulated. The level of recognition of overall quality of life appears to be the evaluation factor in an international competition. As stated by urbanist Paul

Lecroart (Institut de l'Amenagement et de l'Urbanisme, IAU, Paris, France), "*We have to understand that nowadays the value of cities is the richness of socio-economics exchanges…and it is on the life quality that cities of the world compete. Their growth resides on the digital, on the economy of knowledge and on globalization*." Simultaneously, individual users' behaviors change rapidly in terms of mobility and drive towards what urbanists define as "*traffic evaporation*", which poses a difficult challenge to the evolution of the lay-out of urban areas and their management. It appears that the users' behavioral changes such as the modification of itinerary, personal time-plan, transfer frequency, or transportation (e.g. an increasing preference for two-wheels), changes of new family forms of organization, as well as teleworking, and the effect of the sharing economy, all need to be addressed with solutions to be introduced smoothly and through progressive testing.

From the use of space perspective, the digital revolution implies the usage of the same space for multiple activities, allowing a new transition between public and private environments (Ratti and Biderman, 2017). Digital technology, allowing unprecedented measurement capabilities, represents the tool for better design and planning in order to evolve from smart to *senseable* cities, on which the emphasis is more on the citizens and less on technology (Resch et al., 2012).

And when discussing smart cities and mobility, we cannot forget to mention the impact of the digital technology on good delivery in urban areas. The opportunity of building a digital mobile platform allows the achievement of almost just-in-time demand aggregation, which leads to very efficient (time and cost) delivery. Several start-ups such as Deliveroo, Foodora, Postmates and DoorDash, have been heavily supported by Venture Capitals in the last four years. On-demand-urban-delivery providers entered and modified the delivery landscape. The next level of digital technology impact in logistics by wheels would probably be urban delivery by autonomous cars, as envisaged by Amazon, who might play a role at several levels, from delivery service to digital network operator (Bhuiyan, 2017; Stevens and Higgings, 2017). Such digitally-enabled strategy deployment could be the source of an un-precedented global network structuring, when coupled with the ownership of locations and industry-dedicated (f.i. PillPack) and local shipment companies, with financial consequences for actors in various industries, such as warehousing, pharmacy and shipment (LaVito, 2018).

Incentives for platform adoption can be locked-in by one single actor, as in the strategy above described, or they come from the collaboration among different actors, as in the case of EV adoption. In such case, OEMs drive the safety and autonomy of the car based upon the energy stock capacity and efficiency in use, but charging service providers drive the availability and the price of the charging, jointly with the utility provider, who controls the quantity and the cost of the energy

availability, linking it to policies and practices in other sectors, such as home utility use.
The role of the digital revolution has implication for the pace of development in several disciplines, all influencing innovation and shaping the future. Digital disruption has and is still profoundly impacting how and at which pace data is detected, and treated. Robotic mechatronics and the orientation of applied mathematics have seen an unprecedented acceleration in the rate of their progress. Yearly improvement in the performance of technology is not as constant as we were used to since the industrial revolution, where geometrical laws have characterized the last 50 years of technology development.

Therefore, the innovation challenges we face, are much more ambitious than aligning a chip producer (Intel) and a software producer (Windows), because they widen the scope of observation and impact from platform leadership thinking to multi-industry ecosystem design.
The widening of scope and impact is driven by several factors:

- Compelling and clearly stated value propositions are built through the participation of actors from heterogeneous industries
- An integrated view is needed to assess choice and alignment with partners
- Rising users' expectations in almost-immediately available, fully personalized services
- Technological standards driving interoperability are not defined yet
- Regulations related to hot topics such as pollution, privacy and cybersecurity are evolving at different paces in different countries.

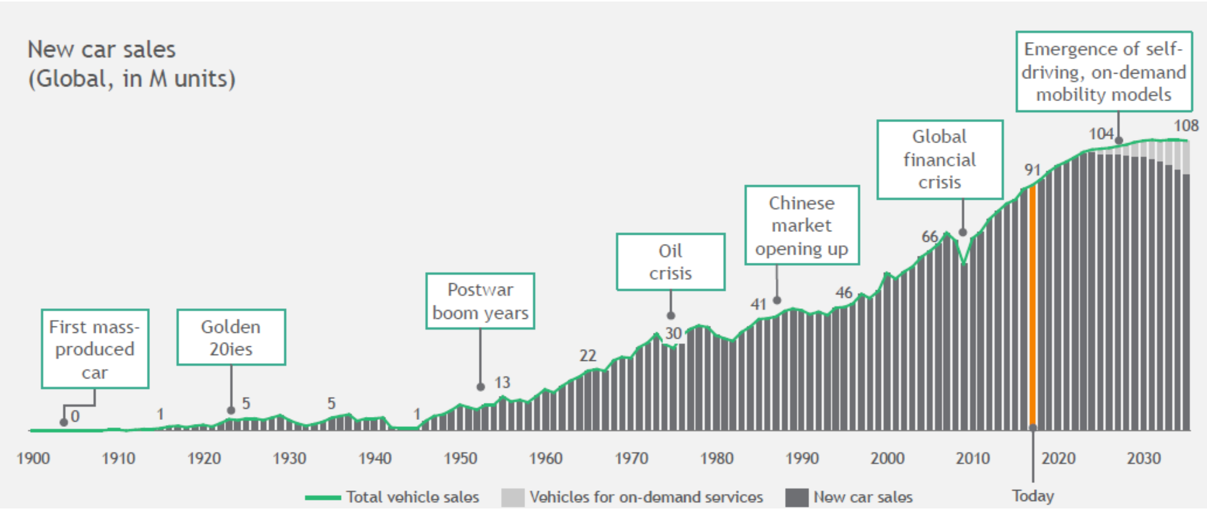
It appears clear that profitability needs to be pursued in the establishment of new ecosystems in which heterogeneous players (including competitors) need to interplay with unknown dynamics and in a relatively short timeframe. This requires resources, time and a certain mindset to effectively and successfully engage in ecosystem creation, and it is in conflict with the traditional drivers of growth strategy and partnership framing. The challenge is therefore how to re-conciliate the tensions described above, by defining the adequate level and timing of the engagement.

1.1.2 The mobility sector as a prominent example of on-going disruption

Among the industries heavily impacted by the digital technology deployment, the one undertaking a deep review of core business definition and strategic action for a sustainable future appears to be the automotive industry. The automotive industry has been widely impacted by the servitization and platformization of their offer (Sumatran *et al.* 2017), and value capturing involves the consideration of roles to be played in future ecosystems.

Warning signals of the paradigm shift happening in the relationship between vehicles and users have been highlighted by several disciplines, such urbanism, sociology and anthropology studies, and supported by economic analysis and predictions, as stated in the following figure (Boston Consulting Group, 2018):

Figure 3 Car sales volumes evolution



Source: (Boston Consulting Group, 2018)

As shown in the diagram here above, the progressive transformation of the offer as well as the demand system contributed to the widening of the scope of the industry itself.

<u>Systemic-ness influencing innovation</u>

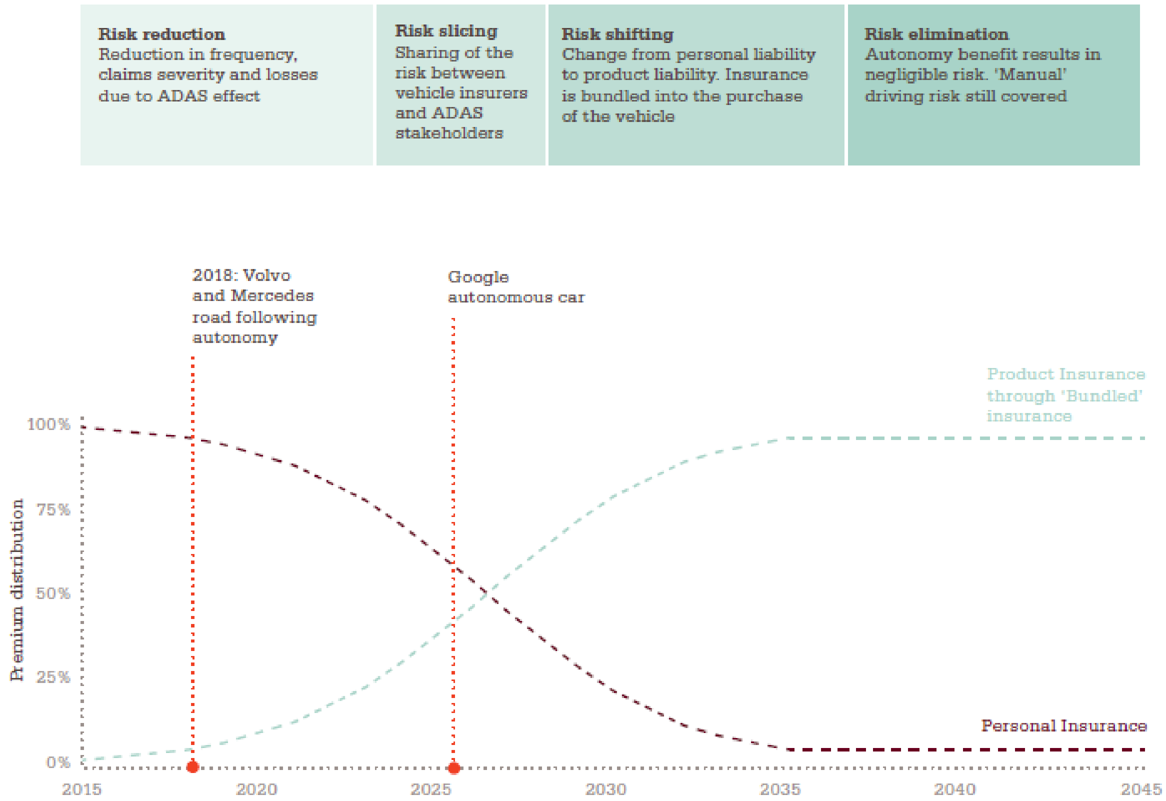
When considering the evolution of the mobility sector and the trajectory of the deployment of the autonomous connected vehicle, it is evident that the transformation of the infrastructure needs several and heterogeneous actors to contribute to the creation of the value proposition. The take-up of autonomous driving will depend on actors jointly enabling the testing process and sharing the related responsibility; the evolution of the insurance models is therefore mandatory, toward an increasing relevance of a product focus instead of an individual focus. Here below a visual representation is presented of stake-holders in experiments on autonomous connected vehicles.

Figure 4 Map of affected stakeholders by autonomous driverless cars

Source:(Miller and Oldham, 2006)

In the case of the autonomous connected vehicle, the consequences on co-creation of attributes of the value proposition are not only on the creation of hardware (the vehicle and the hard infrastructure) and software (IT, cloud and digital platform enabling data flow and aggregation), but also the co-participation to the responsibility associated with the hardware and its use in ways never experienced before. The impacts on the repartition of liability and the resulting evolution of premiums based on forecasted autonomous vehicle take-up are presented in the figure here below:

Figure 5 Model of evolution in liability for insurance



Source:(Miller, 2016)

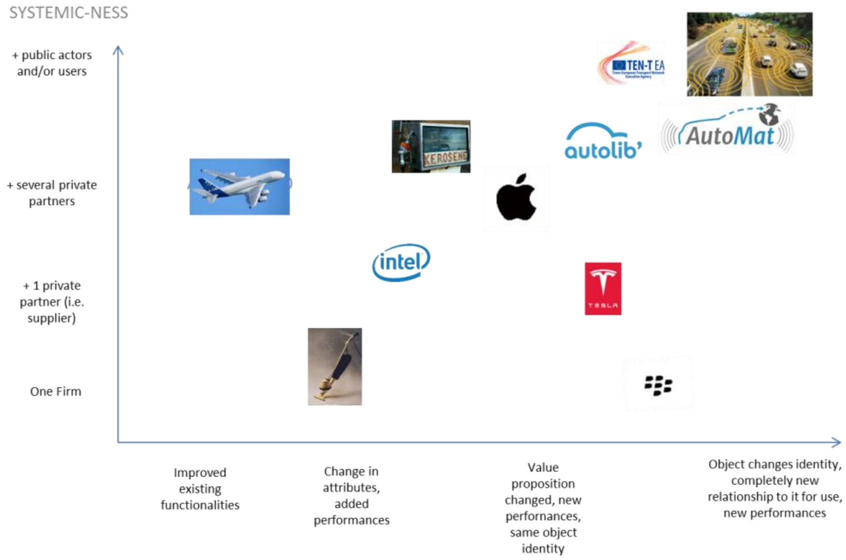
But the actors involved in such co-creation and responsibility sharing must also face a more complex relationship between their output and the user, as we are facing a path of object identity change.

<u>Disruption-ness influencing innovation</u>

Along with the systemic-ness, the autonomous connected vehicle is pulling the mobility sector toward unprecedented levels of disruption in terms of product identity, model of use and performance redefinition.

If we consider innovation in investment intensive industries, such as aeronautics, fuel extraction and distribution, computers and home appliances, we can easily position the autonomous connected vehicle as the industrial innovation case with the highest degree of modification of the relationship with the user, as shown in the picture here below:

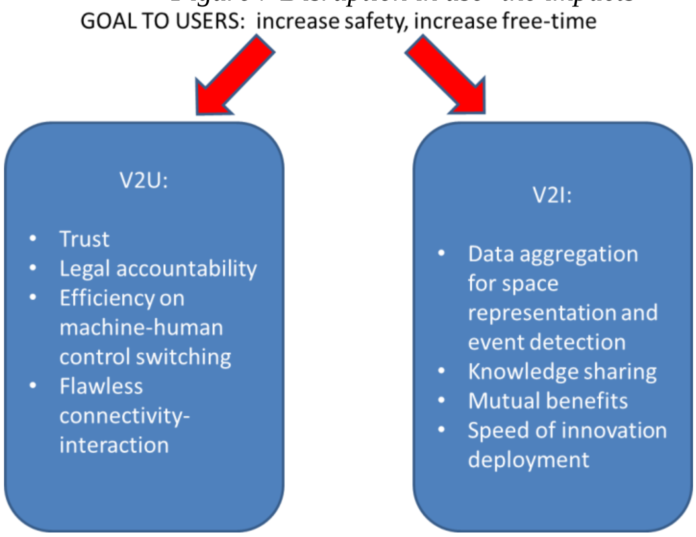
Figure 6 Offer and demand systems complexity



Source: (Marcocchia, 2016)

In terms of the target of the disruption, from the disruption to customers, the sector started to consider the disruption to users, which has impacts on users and on the necessary digital infrastructure for the connected and autonomous-to-be vehicle:

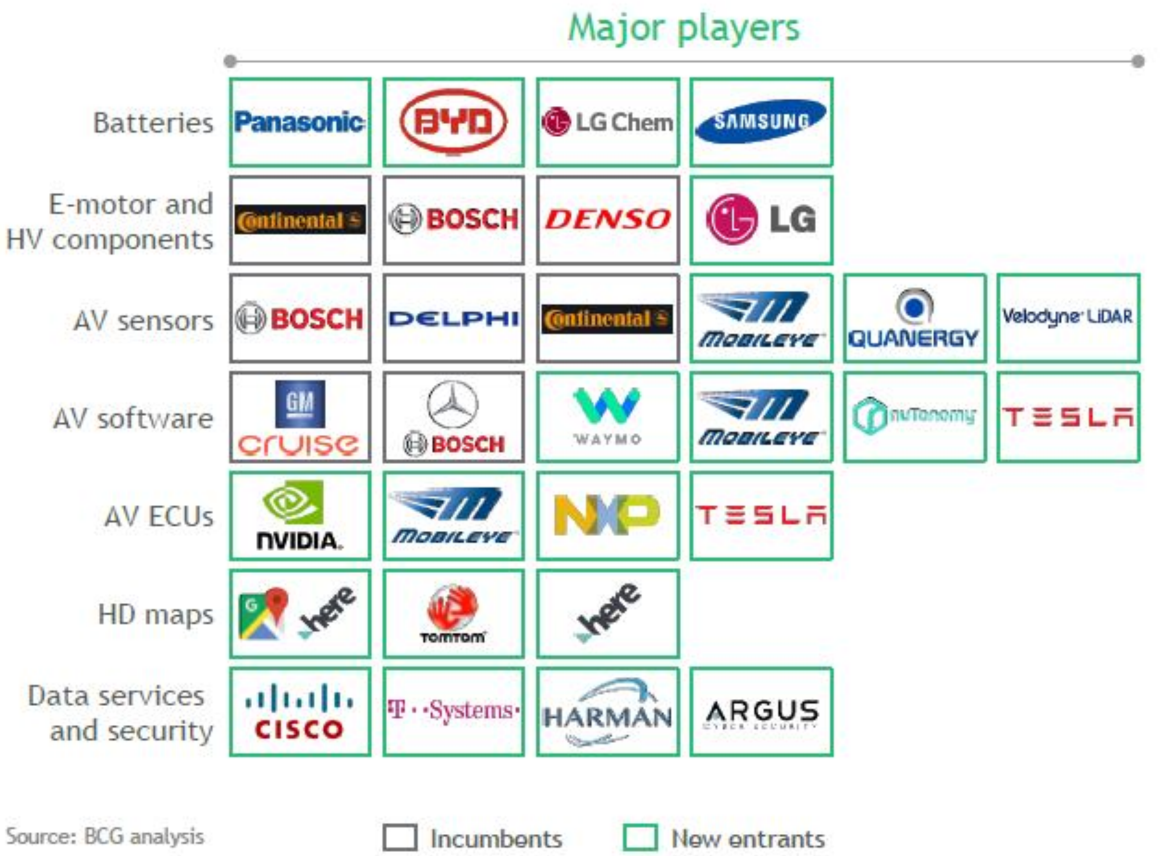
Figure 7 Disruption in use- the impacts



Source: (Marcocchia, 2017a)

The introduction of digital technology in the user experience of the connected autonomous cars is so far driven by newcomers in the industry, who are needed in the value proposition definition:

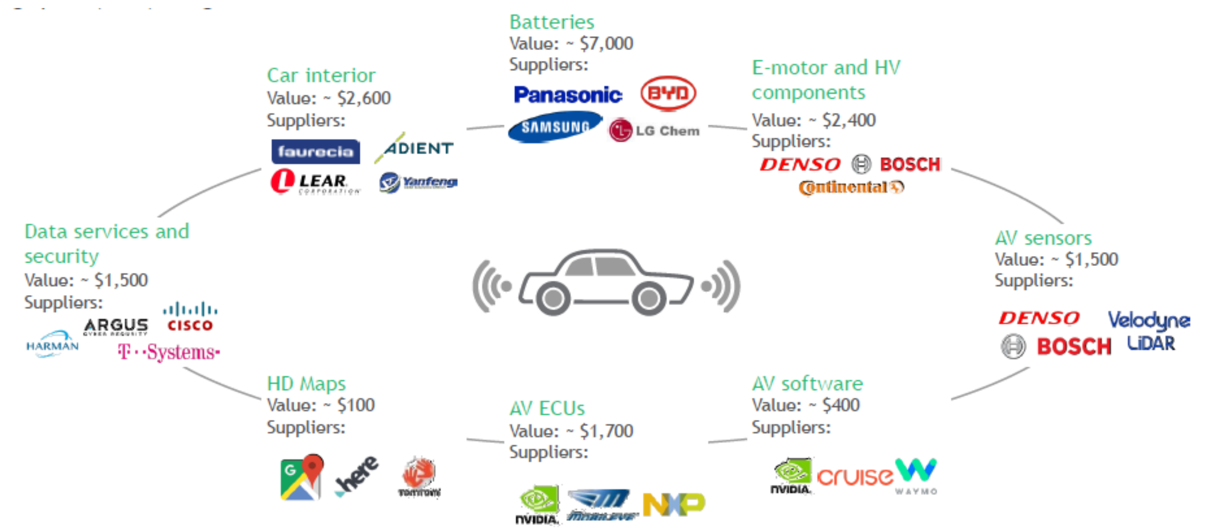
Figure 8 Newcomers positions in electronics and software



Source: (Boston Consulting Group, 2018)

Beyond the deployment of services related to car connectivity, autonomous driving is the highest level of disruptiveness and systemic-ness in innovation that the automotive sector has ever experienced. As Mr Hackett, Ford CEO, stated : *"It is about aligning the technology to what the market wants it to do…..It is a marriage of the evolution of the technology of the vehicle and the evolution of the system it works in"* (WSJ Aug 18th 2017). But the market for autonomous driving does not exist yet, as concrete use cases are not available, and the matching of technology and market needs supposes the two evolve simultaneously. It appears that the matching could not be seen as a precise moment, but it is more similar to an exploratory path along which the matching is mutually defined and steered. Automation and digitalization are all about the creation of new relationships for the participants of an incumbent ecosystem (Wessel et al., 2016) , with current users, new users and new partners. This breaks the established value chain and moves towards an unknown value network. This also results in a massive pressure on changing business models. As stated by the future CEO of Daimler, M Kaellenius, at CES show in January 2018: "*The hearts of our vehicles used to be drivetrains, in the future it will be their hard drives*," and it modifies the way value is created and collected. Re-configurations of value chains are developed, but a stand-alone business model involving only the automotive industry has not been found yet. Here below an example of the value chain of electrical connected autonomous vehicle is presented, with an indication of value for each component:

Figure 9 Value chain of self-driving BEV- USA D-segment in 2030



Source: (Boston Consulting Group, 2018)

As new players come along in the industry, some actors highlight the relevance in specific factors in order to win the race of positioning. Overbeek, CEO of Here said on the competition from Google: "*when companies enter your space, it means you are in a very interactive one. Technology and partnerships are going to give the advantage…partnership allowing scaling from day one* " (CES 2018). Although literature and case studies from global consulting companies proposed guidance to navigate the competition on ecosystems, the degree of systemic-ness embedded in the management of the offer of ecosystems under creation, such as the one which will be generated by connected – autonomous vehicles, is increasingly high. The increase depends on the technology and on the resource management orchestration it will allow.

The main consequence of such disruption is the erosion of margins for incumbents in investment-intensive industries. In the automotive industry, several actions have been taken by incumbents in order to counterbalance such a tendency, by revising their position on the value network, undertaking investments in tech start-ups or through the creation of units dedicated to it, such as General Motors's GM Ventures, BMW Group's i Ventures, Toyota Motor's Toyota AI Ventures and Alliance Ventures of Renault-Nissan-Mitsubishi (RNM). All of them won't lead to a direct profitable offer, or a sustainable robust ecosystem, but potential strategic choices can balance the different logic between innovation exploration and deployment.

As these specific actions confirm, the automotive sector is an interesting object of observation, as it is highly representative case of a challenged industry. It has been an important player in the capitalistic economy at a global scale, in terms of investment intensity, economic weight in countries' GDP, of employment rate influence, and consequently it has historically had a global impact on society and countries' power and influence. Since its origin, the industry has been a powerful source of technological and managerial innovation, such as the production chain, total quality, lean manufacturing, project management etc. Nowadays, there are evident signs of deep transformation going on in the strategic vision of the industry, strongly affected by the digital technologies, as openly discussed by some leaders, such as Akio Toyoda: "*I feel a strong sense of crisis about whether or not we are actually executing car-making…..The present automobile industry is being asked to make a paradigm shift*".

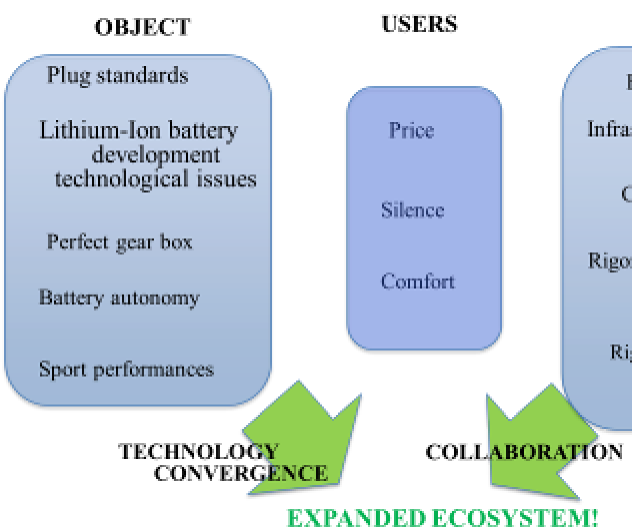
And the paradigm shift is also described for the dynamics of innovation; target becomes the urbanization of the car for delivering the value generated by links, synergies and induced opportunities (Amar, 2016).

Simultaneously, we observe the rising awareness of the inadequacy of current organizational settings, which becomes an issue for incumbents: "*The way we're organized now is not sufficient* » Carlos Ghosn, (Bloomberg interview at CES 2018). Innovations, creativity of startups and support from outside partners have been identified as missing elements of current organizations.

The industry is especially adapted to observe disruptive innovations in the emergence of ecosystems, as the traditional product, a vehicle, is evolving in terms of value proposition and value network positioning. The car is undergoing an identity journey, from being an object to be sold, to becoming a means to provide a service via its connectivity and in future its autonomous action. As said by Jeff Williams, Senior Vice-President of Operations at Apple: "*the car is the ultimate mobile device*" (Ref Code conference speech). Through connectivity and autonomous driving, the output of the automotive industry becomes a means and a resource for other sectors (ITC, energy, social services). Connected vehicles link with social benefits in the urban environment and starts to be proven through simulations, as in the case of the increase on urban road infrastructure productivity associated with the rise of intersection capacity by connected vehicles crossing in platoon formation (Lioris et al., 2017). Such output can be provided only with a very high degree of interoperability and safety performance, achievable through the integration with a large panel of heterogeneous actors. Through their integration, actors contribute to the appearance of a new form of partnerships and competition context. The number and heterogeneity of actors implies recurrent questions about coordination dynamics and value identification.

A current example of such coordination dynamics complexity linked to value identification toward users' adoption is the case of the electric connected vehicle deployment. On users' side, the correspondence between initial expectations and the concrete needs in terms of functions and technology of un-existing product or services are discovered while the offer is formulated. As expressed by many actors and researchers on the EV subject, the features leading to user's needs fulfillments involve convergence in technology and standards and a high degree of collaboration among public and private partners. Convergence and collaboration lead to the progressive definition of expanded ecosystems beyond traditional boundaries.

Figure 10 Consequences of Key Factors in EV adoptions



Source: (Maniak and Marcocchia, 2015)

Based on a feedback from a study on sixteen cities in nine different countries, it appears that "*the chasm between EVs' early adopters and early majority could be bridged by a mix of measures including policies, business models, out-reach and technology improvement toward use easiness"* (Beeton, 2015).

The problematics relevant to policies and business models are also central to the connectivity and autonomous vehicles deployment.

As far as policies, the legal frame in which connectivity is deployed is constantly evolving, and initiatives as GDPR European regulation are considerably influencing the business model formulation (Storing, 2017; Valerio, 2018). Beyond connectivity-enabled services, new policies are also under definition in order to give a frame in the legal issues arising with the autonomous driving, such as liability and fault attribution and responsibility for insurance (AllenOvery, 2017).

While connectivity is recognized from Telcom Providers as possibly having a positive impact on ROI of fleet commercial operators (Vodafone Automotive, 2017), the deployment of the autonomous driving is not proven to be return-valuable compared to the investment needed on the incumbents' side. In order to really deploy such offers, as part of wider technological advances such as “smart cities”, “smart mobility” and “smart home”, a complex set of heterogeneous players have to create offers which are far from their core business, investing with a high uncertainty about the Return on Investment (ROI). ROI and its sustainability over time depend on the capacity of value capturing. Nevertheless, value creation and capturing strategies become complex and related to the role firms decide to play in the ecosystem (Jacobides et al., 2006; Jacobides and Tae, 2015). Firms are getting aware of the widening of the related ecosystem, intended as alignment structure (Adner, 2017), and of the need of new relationships to move forward.

As per the above considerations on the challenges in managing systemic and disruptive innovation in several sectors, and more specifically in the mobility one, it appears that ecosystems are not an element in which innovation is inserted as top down process, but as an increasingly important locus of innovation exploration. How actors navigate in such locus is the focus of our theoretical investigation.

1.2 Theoretical context

The above described economical and industrial context led us to investigate the position of academic authors related to topics such as platform strategy and ecosystem dynamics, innovation management and design approach to the unknown.

Platform leadership (Cusumano and Gawer, 2002; Gawer and Henderson, 2007), value chain dynamics (Fine, 1998; Jacobides et al., 2007), alliances and complementary assets (Teece, 1986) provided extensive and critical guidelines and frameworks to go beyond the “firm centric” and “product centric” approach. Prominent authors in the field of management described the supplier value chain dynamics in case of incremental innovation (Fine, 2000; Jacobides and MacDuffie, 2013).

In the context of systemic (Teece, 1996) and disruptive (Bower & Christensen, 1995) innovation, a strong alignment of players during the project is required. The vertical integration stands as an apparently efficient model to provide such alignment (Teece, 1986). As far as the investment integration is concerned, the positive impact of vertical integration has been proved in case of complex interdependencies in new technology implementation within a firm (Armour and Teece, 1980), as well as the need of investment in complementary capacities beyond internal R&D (Teece, 1988). But such solutions do not take into consideration the ecosystem context and the uncertainty degree we experience nowadays with digital disruption. Nevertheless, literature provides elements on double sided effects and platform dynamics once the platform operational rules are set, but the rules ongoing definition derived from a highly systemic and disruptive innovation context is not fully addressed.

Companies like Tesla managed to develop in parallel highly innovative offers, including products, services, infrastructure, etc. Even if the vertical offer is not owned by a single entity, literature points towards strong “platform leadership” actions to encourage complementors to invest upfront and to align their road maps, building together a growing disruptive market (Cusumano and Gawer, 2002; Gawer and Cusumano, 2014).

An alternative solution to such innovation challenge has been proposed by the literature on network ambidexterity. Tension between innovation exploration and deployment can be solved by network ambidexterity, mainly through alliances (McNamara and BadenFuller, 1999); the focus of related researches was set on individual firms and their performances in accumulation and exchange of resources (Lin et al., 2007).

As far as the ecosystem management is concerned, existing literature focus is on strategy analysis for already established ecosystems. Several definition had been given on ecosystems (Adner, 2017, 2006; Adner and Kapoor, 2010; Gawer and Cusumano, 2002; Kapoor and Lee, 2013; Moore, 1993; Pierce, 2009; Teece, 2007; Wareham et al., 2014), and the fact that an ecosystem follows a maturation process from emergence to stabilization and renewal (Moore, 1993) has been stated. Nevertheless, the process of creation of these arrangements is still quite underexplored. The need of co-evolution of roles in the business ecosystem has been identified (Moore, 2006), but the process of ecosystem shaping is still to be investigated (Jacobides et al., 2018). From the executives’ teams’ perspective, the mayor challenge of strategy decision making appears to be the use of the system-design perspective to strategic planning (Kenny, 2018).

As a holistic input of this stream of literature, the ecosystem appears to be the relevant unit to be considered for assessing management issues meaningful for value creation and future competitive positioning. Researches in the strategy field are particularly focused in the ecosystem as object of study, highlighting the impact of interdependence relationship among an increasing number of heterogeneous actors.

As far as the innovation management literature is concerned, most of the existing production is linked to development project (Clark and Fujimoto, 1991; Lenfle and Loch, 2010; Loch et al., 2006; Midler, 2013; Thomke and Fujimoto, 2000), which seems not adequate to the challenges posed by the high level of technological and market uncertainty that firms face. There is a recent development on a specific typology of project research, which represents an improvement toward the current requirements of innovation management. The need of flexibility degrees in discovery and adjustment in so defined exploration projects has been identified (Lenfle, 2008), but such research is related to one individual firm, and not to a context of ecosystem dynamics. The perspective of heterogeneous partners' interactions has still to be analyzed.

The issue of co-construction of a systemic offer is also tackled in the case of project management of Public Private Partnerships, in order to improve governance and project performances (Laura et al., 2010; Li et al., 2005; Markard and Truffer, 2008) with some elements on strategy (Pinske et al., 2014). The deployment of highly systemic and disruptive innovation appears then linked to socio-cultural, economic and legal frames evolution, as already described for sustainable technologies (Kemp et al., 1998). In this context, the relevance of dynamic alignment of private and public actors for systemic and disruptive innovation management has been clearly identified (Pinske et al., 2016). Private and public players try to be proactive in such disruptive and systemic offers through intensive investment and "partnerships" which aim to prefigure future integrated services and dominating platforms.

All the above elements from innovation management literature confirms the relevance of the projects in igniting innovation dynamics; guidance is provided in terms of managing principles of innovation projects, and of the strategic role projects can play in building organizations' competitive advantage through direct and indirect contributions (for instance in the case of assets dynamics).

Bridging these streams of literature points a blind zone: the ecosystem / platform literature only consider that collaborative projects aim at delivering a profitable systemic offer (and fail if they don't), whereas the innovation management literature points towards a "exploration project approach" (Lenfle, 2008) which recognizes and put under control that the final offer, the relevant partners, the market is to be defined during the project relying on a "learning by project approach" (Brady and Davies, 2004; Maniak and Midler, 2014). Furthermore, co-innovation literature contribution concerns a limited number of actors, while the conditions observed are setting the area of study to a higher level of systemic-ness in the offer dynamics.

As we are investigating the unknown, design literature has been explored in order to provide elements on cognitive process toward collective creativity, users' context understanding, creative mediation, collaborative platform design, artefacts use and design driven product innovation process. Elements on interests' aggregation and networked infrastructures were searched in the innovation sociology discipline to contribute to the above.

The reviewed existing academic contributions provide elements for a better definition and understanding of the concepts widely associated with the topic of existing ecosystem dynamics and structure, but the research on emergent ecosystem appears to be still in its infancy, orientated toward analysis of historical phases of emergency and blind spots appeared to be left in case of strategy management in currently emerging ecosystems.

How to support emergent ecosystem stakeholders, who face a working context within the constraints of the current unstable and fast evolving state of affairs, requesting actions on a hard-to-embrace sustainable and under-design overall roadmap?

The strategic management approach, that could drive to partners' alignment dynamics, with impacts in their positioning on the value network, in value capturing and therefore in financial sustainability, is still under-explored.

We think that there are at stake here the factors of strategy definition and decision making which will impact long term profitability of firms setting conditions for ecosystem structuring through the participation to systemic and disruptive innovation projects. Such conditions will impact the creation and sustainability of value encompassing the economic aspects and including social impacts.

1.3 Considerations on the literature review

By bridging the empirical context and the theoretical investigation, it emerges that the ecosystem is the adequate perspective for studying the systemic and disruptive innovation exploration and deployment processes. The literature on innovation management, ecosystem and platform dynamics covered the analysis of how to manage relationships toward innovation deployment, although these two streams of literature evolved mostly independently. Strategy literature elucidates the relevance and the mechanisms of ecosystems already established, as well as their role in the innovation deployment, but few elements are provided on the initial steps of innovation exploration and its relationship with ecosystem structuring. The literature on innovation management highlights the key role of projects in resources mobilization, in keeping the focus on the final target, as well as in mastering performance criteria such quality, cost and lead time; literature also elucidates the role of the project as enabler of assets renewing dynamics for organizations, when facing multi-products challenges. But the angle of observation from which such inputs are derived is mostly from a limited number of actors and on the same linear value chain; few elements are provided on how to drive a set of partners to engage in it and get aligned when the both offer and demand systems are unknown.

From a complementary perspective, objects and concepts from the design literature contribute to highlight the relevance of the collective action of creating a structure and to jointly enable the creation of a dialogue space and knowledge creation and sharing through representations, interpretation and transitions. Artefacts have been considered in their role of cognitive process enablers, as potential contributor to the engagement process.

The insights provided by existing literature enable managers to perform strategic decision making when rules of the game are set among known actors, but not when the actors and the environment are progressively defined. Nowadays, managers from private and public institutions need to get aligned with variable internal, external conditions, time perspectives, and ill-defined demand system; they miss guidance on how proceeding with it.

Once the challenges have been identified, we can formulate the research question and detail the analysis frame underlying this PhD adventure.

1.4 Research question and PhD design

As emerged from the empirical context and from the literature review, a gap on management guidance for systemic and disruptive innovation management in a strategic ecosystem structuring context is missing. From this gap, we identify three questions which answers should provide guidance to public and private managers in such situations. The research questions are presented here below, as well as synthetic elements on the methodology we design for this research journey.

1.4.1 The research questions

Based on the above elements from the empirical and theoretical context, our research focuses on the relationship between the ecosystem and the multi-partners' project in the context of systemic innovation dynamics. Both, the observation of facts related to evolution of several industries and the existing literature on ecosystem and innovation management, they highlight the relevance of additional insights on how heterogeneous partners achieve alignment in such a context during innovation exploration, as a key step toward the ecosystem's structuring and systemic and disruptive innovation exploration and deployment. Therefore, we question how an innovation project can be effectively managed in such conditions, if there is a specific pattern to be followed and which variables impact project steering. How can we assess the performance indicators and mediating variables impacting the performance achievement?

Literature review in design and innovation sociology disciplines elucidates the multiple roles of artefacts in the cognitive aspects of the exploration process, but not insights are provided for the effective selection and timing of use of artefacts in the context of systemic and disruptive innovation.

Based on such elements from literature, we question the typology and timing of artefacts use in the collective exploration process.

1.4.2 Research Methodology

Choice of the site

Once the gap identified and the research question formulated, we confirmed our initial interest in the mobility sector. As far as choice of the industry and the projects to participate, the current turmoil of the automotive sector in terms of technology, object, value network and business models contributed in identifying the mobility sector as the investigation field with innovation management challenges at the high degree of systemic-ness and disruptive-ness.

The choice of projects

Three projects were chosen as their typology is coherent with project characteristics relevant for systemic and disruptive innovation (multi-heterogeneous partners) and as they are all contributing to design the interaction space and to structure the autonomous-connected-electric-vehicle-enabled mobility ecosystem. The ecosystem is the innovation locus defined by both, the empirical and the theoretical context.

All projects have several heterogeneous partners, private firms and public organizations from different countries, aiming at building a sustainable platform for services deployment related to the connected vehicle.

The selected cases focus on topics at the core of the discussion for smart mobility, such as the creation of new physical and digital infrastructures, new user experiences and revenue from car data, and autonomous driving. The projects play a role in smart mobility enabling innovation diffusion at different stages of maturity, and they all have a high level of potential impact in the strategy of the involved partners.

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), aims to deploy 200 EV charging stations in two years along a national highways network. The second one, developed by a consortium formed by three carmakers, two service providers, two private IT and cloud operators and one academic institution (we were part of it), aims to create the prototype for 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 (we were part of it), aims to create a shared vision of the autonomous mobility, as a first step toward profitable services for autonomous driving integration into local urban environment.

The approach to data collection and analysis

Based on the constructivist epistemology approach, the qualitative methodology has been selected for observing the structuring and evolution of collective action. The research design is based on the research-intervention method, through the active participation of the researcher to the three projects chosen as cases to be observed. Through intervention research protocol, we could effectively participate to actors' evolution process on a time frame relevant to change dynamics ignition and understanding. We observed the evolution of opinions, judgements, objects and shared representations collectively built.

As per the complexity and the evolution dynamics of the object to be observed, we choose to perform an iterative path, with loops between the literature analysis and the data collection and analysis. From the literature review, we identified concept and factors to be observed relevant to existing ecosystem dynamics and innovation management within context uncertainty. The evolution of literature review was coherent with the evolution of the observed projects, and new management challenges progressively discovered. The iterative process allowed the consideration of analysis dimensions which were emerging along the process of ecosystem definition and that were not foreseen-able at the kick-off of the research project or of the observed projects.

The selected cases provided abundant data from which we detected the elements relevant to systemic and disruptive innovation management related to ecosystem structuring and needed to answer our research question. Such cases are a sampling of a same phenomenon, ecosystem structuring around digital enabled platform, and they have been selected in order to observe innovation at different stages of its maturity. The choice of such a methodology is coherent with our research object (Weil, 1999), because it is rooted in exploration, toward a simultaneous evolution of research hypothesis, theoretical findings and concepts allowing the representation of real situations and models for action ignition and performance assessment.

Empirical cases have been analyzed using frames initially defined. Frames set at the beginning evolved toward a progressive integration of the feedback received from the field observation, and it resulted in the generation of tools and frame for project management and further data collection and analysis. The followed path has been a back-and-forth process between empirical data and modelling.

Formalization of case studies

The collected data were analyzed and processed using qualitative methodologies described in literature, such us coding and storytelling (Dumez, 2016; Dumez and Jeunemaitre, 2006; Yin, 1994). The emergency of relevant factors through the projects development allowed us to design frames of analysis, and tools for both, project goal achievement and simultaneous artefact performance testing. Processes such as the dynamic of actors, evolution of objects and interactions have been reported using the storytelling, the 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).

Tools definition

In a first part, we position ourselves compared to existing literature in the field of ecosystem management, in order characterize the factors and dynamics identified as key for its sustainability, and in the field of innovation management to explore systemic innovation management processes and tools related to such uncertain context. The exploration of the design literature helped clarifying the cognitive process humans, individually and collectively, perform and how design methodologies ad objects as artefacts might contribute to the process.

Through the active participation to the projects, we had the opportunity to observe and to contribute to the partners' path toward project completion. Challenges were various, from heterogeneity of partners' goals and internal procedures, to the lack of definition of offer and demand side in the platforms projects were based upon. In order to support projects partners in solving the chicken&egg dilemma between demand and offer definition, and simultaneously explore the boundaries of the ecosystem, artefacts as management tools and objects were identified, proposed or collectively developed, in order to progressively build alliances in order to co-define user needs and platform offer when technical standard underlying offer and demand characteristics are not stabilized yet.

1.5 Results

The described iterative research path allowed the achievement of different types of results, from elucidation of innovation management process, to strategic insights for decision making in project choices for value creation through systemic and disruptive innovation in the ecosystem framework.

From the innovation management perspective, we find elements to elucidate that systemic and disruptive innovation projects present seven key management challenges partners have to face.

Challenges span from concept understanding to target definition. They can be designated as the alignment of concepts and representation for value proposition definition, the information sharing among partners, the alignment of in-house effort with project effort, the focus toward project completion, the awareness of the strategic relevance of taking part to ecosystem related projects, the necessity of considering a wider target of project, and the recognition of specific factors as ignitors to individual and collective action. The dynamics of actions performed to overcome the challenges drives to the identification of the process of partners' alignment toward value proposition and concurrent and progressive structuring of offer and demand systems through technical standards and service attributes identification. Such alignment contributes therefore to the progressive structuring of the mobility ecosystem. During projects development, it appeared that demand and offer structures emerge as results of iterative process in which partners progressively explore the offer and demand in the project space, and influence in-house processes for allowing the project to move forward.

The path appears to be a collective and individual journey from several perspectives; as cognitive evolution, as organization structure management and as social relationship-network structuration. The interplay between the management challenges and the consequent actions from partners is formalized in a sequence of four phases, through which partners overcome collectively the challenges and move forward the structuring of the ecosystem of the connected autonomous vehicle. The four phases are related to concept sharing, to the recognition of failure of targets initially associated to the project, to the readjustment of in-house practices to accommodate project needs, leading to the phase of external value network extension and in-house network expansion. As an additional element to the consideration of the alignment process, we show that the user involvement contributes to value proposition definition and to partners' alignment in ecosystem related projects with un-defined offer and demand systems.

We also put under evidence the relevance of the cognitive and linguistic dimensions of the alignment process. The management of such dimension is treated by recurring to the design discipline. We put under evidence that for the effective management of the above dimensions, *qui pro quo*, concepts, new words, all these elements represent a key variable to be managed since the beginning of the actors' involvement in collective action.

The assessment of each project on the prism of the mediating variables elucidated by the literature guides us through the identification of project settings evolution, actor's alignment challenges in a networked context, and the knowledge management path partners performed individually and collectively.

We also provide insights on the typology and timing of artefacts use, related to the performance achieved in the cognitive gap filling among partners.

From the strategy perspective, we propose to define such moment of structuring with the notion of « **proto-ecosystem** » project in order to describe the process of collective action aimed at conceiving and setting the condition for deployment of a systemic (and potentially disruptive) innovation.

It appears that partners need to consider the participation to such projects as part of wider value-creation strategy, including a portfolio which management requires level of cooperation among actors never experienced before by incumbents in a given sector. In order to create a product or a service which addresses simultaneously the systemic-ness of the offer definition environment and the disruptive-ness demand-value proposition environment, all the actors involved in the product or service delivery are requested to operate in a more agile and collaborative modus operandi, contrasting with the traditional habits of established organizations. In order to create a desirable, valuable(and therefore adoptable) product or service, a strong ecosystem of conception is needed, and the strength of it is defined by the level of cohesion among participants, who should embrace a same vision on how to gain a competitive advantage and the same risk of investing upfront, accepting a delayed validation and judgement. Project perimeters and settings might be object of evolution without jeopardizing the performance of the goal achievement, but achieving it through the evolution. Such projects should be clearly differentiated by other innovation projects. We identify four typologies of proto-ecosystem projects, on the basis of a 2-factor segmentation (Interaction with headquarters and Project framing). Each typology presents advantages and disadvantages related to a set of generic mechanisms we identified for the innovation deployment.

As a complement to the above assessment from a strategic decision making perspective, the evaluation of the absorptive capacity per actor and per project, results in key inputs to decision-making guidance in terms of internal organizational and project setting toward better innovation exploration and deployment performance. All partners increased their absorptive capacities, although they did it at different levels. As taking part to proto-ecosystem projects generates more uncertainty of what was originally taken into consideration, the willingness to further invest into the project itself varies among partners and it influences the increasing of absorptive capacity. The different reactions might be related to each actor organizational setting and history and strategic path in terms of evolution of positioning into the value network. A quickly moving field might de-incent firms to invest in absorptive capacity, resulting in a low-value-capturing positioning in the future.

From a strategic perspective, we elucidate the process of linking the project and the ecosystem. We will show in our discussions and findings that an unexpected result appeared: innovative actors do not chose to get involved into an ecosystem because of an inside-out path driven by assets or strategies defined upfront, but following an outside-in path driven by the project that plays a key role in igniting internal strategic dynamics of ecosystem partners. Furthermore, the potential failure of a proto-ecosystem project in ecosystem structuring might not be negative, as value for each partner can be fostered in other areas, if linked to a multi-lineage project perspective and strategic assets building.

1.6 Structure of the thesis

The starting point of our research journey is therefore a comprehensive literature review in the disciplines we assessed as relevant to the research question, such as Strategy, Innovation Management, Design and Innovation Sociology. The literature review is presented in Chapter 2 (Literature Review), with the indications of the theoretical frames relevant to answer the research questions. At the end of the chapter, we present the gap we identified and that we aim to bridge through our research. The empirical context and literature review elucidates the management difficulties linked to context heavily characterized by the un-stability of factors defining the environment on which players are requested to act. The research Methodology presented in Chapter 3 is designed for capturing in the most effective and thorough manner the salient factors and dynamics of such management situations. The dynamics of actions among partners on the three projects are rendered in the form of storytelling in Chapter 4 (Cases description). From cases presentation, we present the elements emerging from data analysis, such as paths, impacting factors, challenges and projects specificities, which will be highlighted in Chapter 5 (Findings and Discussion).

The research work will be wrapped up in Chapter 6 (Conclusions), by a synthetic overview of the research journey to the results, including theoretical and managerial contributions. Our work is concluded by our assessment on potential paths to be pursued for future research in exploration project management, as well as in sociotechnical regime shifting and users' adoption models in the context of ecosystem structuring.

2 LITERATURE REVIEW

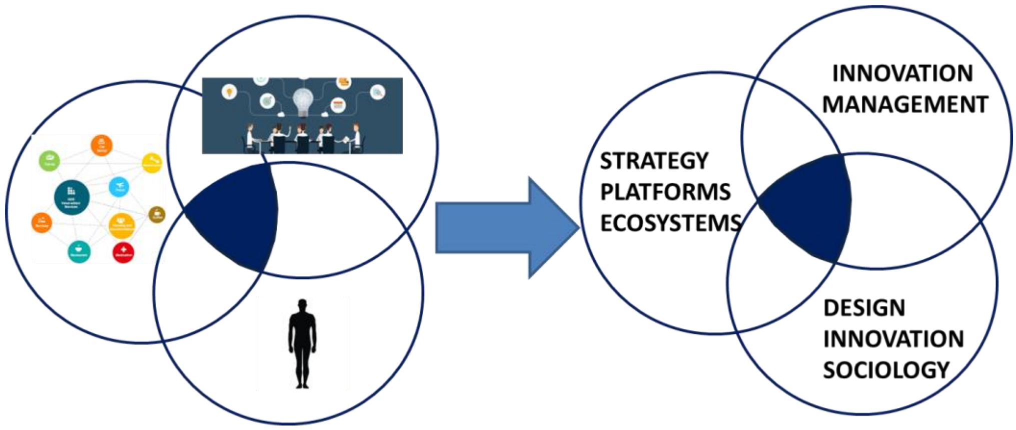
2.1 Introduction

Our focus is on the relationship between the ecosystem and the multi-partners' project in the context of systemic disruptive innovation dynamics. How to manage innovation and align partners in such contexts of stakeholders' action and users' perspective? It questions the linkages between ecosystem, innovation management and individuals taking part to the innovation process. The research question aims at clarifying how project partners achieve alignment in such a context and how such projects nurture the organization strategy through eventually participating in the ecosystem's structuring.

This chapter is dedicated to reviewing the relevant literature related to this question. The question is a social, management and design inquiry at the same time. It is interdisciplinary by the very depth of its location in the realm of situated problems.

As per the elements assessed on the empirical context, it appeared that one single discipline would not provide models paradigms to answer our research question, and therefore we selected the three disciplinary fields which we considered as complementary in giving the thoroughness of analysis.

Figure 11 Choices of literature review fields



Based on the selection of literature fields relevant to our research question, we elaborated a plan in order to systematically conduct the literature exploration.

In a first phase, the analysis of the innovation management literature began with a "firm-centric" and "new product development focus", and progressively extended into two directions (i) extending the scope of players involved, however disregarding the "ecosystem" perimeter (ii) and pointing to the necessity to take into account not only the product but also the multi-product underlying asset dynamic.

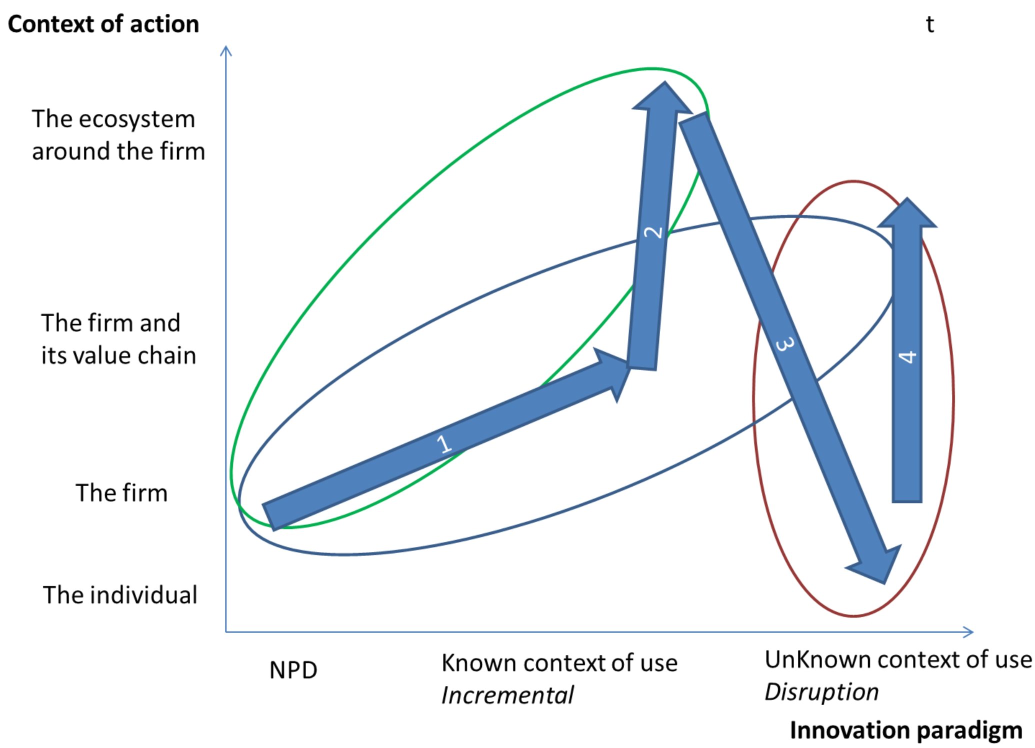
This calls for investigating the strategic literature as a second step. We will tell a story of this field of literature, showing its extension (i) from a firm centric approach to a value chain scope, and then to an ecosystem focus (ii) from a relatively defensive “competitive advantage” paradigm to an “innovation based competition” paradigm, where speed of learning and absorptive capacity are key.
Because of the disruptive aspect of the innovation, elements from the literature regarding the value proposition definition and desirability toward users were included in our theoretical exploration.

As we are projecting ourselves into the unknown to be designed and collectively accepted, our literature review journey will include a third step as a deep dive into the arena design and innovation sociology, in order to add inputs on (i) individual and (ii) collective cognitive and (iii) artefacts contributing to the alignment of the partners. Such process will lead us to include the logic of individual and collective exploration of unknown into an ecosystem-structuring perspective (fourth step).

The plan of literature review we designed and complied with is presented here below, with areas of main interests according to the literature identified as follows:

- Red: design and innovation sociology
- Blue: Innovation management
- Green: strategy perspective, ecosystem and platform
- t: time as diagonal dimension

Figure 12 Literature review time-plan and steps



The path followed while analyzing the literature is explained by the need of deeply understanding the obstacles and the opportunities behind the action in the ecosystem and the innovation locus of relevant strategic considerations. We progressively analyzed each discipline from the narrower scope of analysis in terms of the innovation paradigm and the context of action, toward the most challenging one, described by the higher level of complexity of the context of action (heterogeneous partners engaged in an ecosystem dynamics), and the higher level of disruption in the context of use (toward the unknown realm).

In this chapter, the reader will find the introduction to the three disciplinary fields and the literature review focused on the inputs academics provided from each angle to contribute to answer the research question.

We conclude the chapter with the results we found from the literature investigation and the highlights of the gap we identified and we aimed to fill through our work.

2.2 Innovation management: perspectives from firm to ecosystem

In the aim of exploring the phase of emergence of ecosystem in case of systemic and disruptive innovation, our literature review naturally evolved to the detailed analysis of the available findings on how organizations deal with innovation challenges from firm to ecosystem level. Competitive advantage seems unreachable if not coupled with a high level of digital technology, but technology per se does not drive to such advantage if is not transformed into valuable deliverable for the users. Strategic decision on value creation toward organization's sustainability is also a matter of effective management of the exploration and deployment processes. Which are the factors beyond technology relevant to and which are the processes enabling the capture of such dynamic context? Let's explore what has been said so far by academics.

2.2.1 Innovation management at firm level

Firms challenge for detaining a competitive advantage is related to their capacity to differentiate from competitors by repeatedly introducing innovation. Innovation sought by firms is nowadays performant if deployed at fast pace and if it generates destabilization of objects identity and of dominant design (Hatchuel et al., 2002; Le Masson et al., 2006). We are in the arena of intensive innovation, output of firms activities must be renewed fast and firms can create value only by innovation.

2.2.1.1 The seminal "school of thought"

The discipline of Management emerged from the needs expressed by companies. Taylor and Fayol, concerned by low productivity of the factories and bureaucratic heaviness, they theorized principles from practice in order to serve their role as leading managers and other managers who encountered similar problems. Then the management research focused on case studies as the best method to train leaders (Jolly, 1933). Only later, between 1950 and 1960, the specialization of functions drove to the need of a set of techniques and of tools to be applied in a systematic way. One thus attends the constitution of management like engineering, seen like the continuous improvement of techniques (Hatchuel, 2000).

Literature in management has tackled group dynamics (Lewin, 1951), hierarchical control (Weber, 2009), political games (Crozier and Friedberg, 1977) and employees decision making. From the consideration of employees as "automats", authors moved toward employees guided by "bounded" rationality, involving that they make decisions on the basis of a simple and individually-understandable model of reality (Simon, 1983), using only partially satisfying but accessible solutions (Cohen et al., 1972), and relying on external judgements and evaluation (Riveline, 1991) or "invisible technologies" (Berry, 1983).

Innovation management emerged in the 1960 as a way to optimize R&D expenditures. It was born in a context where R&D investments became increasingly legitimate in big companies, relying on compatible economic paradigms (Solow, 1974). Innovation management first appeared as forms of R&D (Roussel et al., 1991), then authors progressively shifted their lenses to more focused approaches. The New product development (NPD) paradigm has dominated the literature from the 1980s to the years 2000s. It put the emphasis on team coordination and optimization of resource allocations and investments toward defined goals of time-to-market and cost reduction.

Historically, innovation management has been focusing on new product development. Scholars and companies have been wondering about how to improve quality, cost and lead times of development projects (Clark & Wheelwright, 1993; Clark & Fujimoto, 1991; Midler, 1995).

This contributed to dramatically improve theories and methods, theorizing and implementing concurrent engineering, multi-project rationalization through platform strategies (Cusumano and Nobeoka, 1998), frontloading approaches (Thomke and Fujimoto, 2000), fuzzy-front-end and advanced engineering management (Khurana and Rosenthal, 1997).

In order to achieve the target of development time reduction, concurrent engineering implies management principles such as: (1) to have the finality of the project as a collective first-ranking priority and not only as a consequence of functional units roadmaps (2) to install an heavyweight project manager as a transversal coordinator, who might be heard from the hierarchy and be legitimate, (3) to foster the ability to intersect feasible sets of design spaces (Sobek II et al., 1999) (4) to have experts not only give opinions or “best effort” but rather making them commit on expected results (5) to have a framework for the design process management, in which tasks are evaluated depending on their impact on the development cycle and convergence problems be addressed (Eppinger, 1991; Yassine and Braha, 2003).

Firms performing in cost reduction while introducing innovation historically were linked to multi-project rationalization through platform strategies, developing platform for one product and quickly transfer it to other products, coupling this with a new organizational structure.

Product development cost reduction has been positively correlated to the interplay between new and current technology, highlighted as a key factor in performance of Problem Identification and solving anticipation to the very early stage of product development (Thomke and Fujimoto, 2000).

As interrelationships of components of a strategy have been proved to be among the drivers of the strategy performance, product strategy and project portfolio plan must be considered simultaneously in order to provide overall coherence to advanced engineering management (Khurana and Rosenthal, 1997).

The diffusion of these theories allowed increasing the pace of new product launches maintaining R&D costs under control.

While assessing the evolution of the NPD studies, we noted that a paradox appears between new product management, and innovation management, as innovation based competition (Brown & Eisenhardt, 1997; Midler, Benghozi, & Charue-Duboc, 2000) got increasingly tough, differentiating on ever more fast-moving markets called for ever more innovative products, while streamlined product development processes can only deliver products in line with the *dominant design* (Abernathy & Utterback, 1978; Leonard-Barton, 1992). This stands as a great paradox since project management initially ambitioned to manage innovation (Lenfle & Loch, 2010).

As open innovation kicked in, involving the commercialization of innovations from other firms and the deployment of pathways outside their current businesses to bring new concepts to market (Chesbrough, 2003), firm's formal engagements as technology alliances among firms to support individual innovation initiatives by technological resources' combination (Deeds and Rothaermel, 2003; Dittrich and Duysters, 2007; Hagedoorn, 2002; Poot et al., 2009) must evolve in order to increasingly consider external players not only as classical "suppliers" or "partners", but rather as "complementors" (Yoffie and Kwak, 2006) which have to co-invest upfront with the focal innovating firm. Each has to develop complementary assets and offers (Teece, 1996, 1986).

2.2.1.2 Innovation Management from the viewpoint of the firm

A relevant evolution of this stream of literature is therefore linked to the innovation embracing as a key element to competitive advantage building.

The first element of such evolution is the consideration of innovation models emergence and selection. Once organizations embark in the journey of competition based in innovation, how do they should get organized in order to manage performance in innovation projects?

The linear model of innovation management (Kline and Rosenberg, 1986) seems not applicable in cases of innovation requiring a considerable amount of knowledge creation (Charue-Duboc, 2007; Charue-Duboc and Midler, 2002).

Furthermore innovation perturbs established firm's systems of production and marketing at different scale, depending on the distance to current technological competences and linkages to market and customers (Abernathy and Clark, 1985).

Exploration through multi-project lineage management has been highlighted as effective for the innovation performance of a firm (Maniak and Midler, 2014). Such approach to innovation might lead the firm to build innovation capabilities if the innovation portfolio is managed with political astuteness and learning perspective (Börjesson et al., 2014), as well as to enhance value capturing through the re-evaluation of the opportunities and the assets built during each exploration project (Maniak et al., 2014).

As further element to give guidance to the exploration process, scholars identified a new type of project called “exploration project”, which aims to explore promising value arenas, discovering and adjusting along the project its specifications, strategic impact, required partners, etc., and by applying the expansive logic (Lenfle, 2016, 2008). The management of such projects requires shifting from a “cost-quality-lead time” control perspective to a learning-based project management perspective.

Performance of exploration accomplished by teams appears to be linked to the consideration of the *Full Value* of an innovation integrated in a system, and to the Full-Value-guided project governance steering upfront the exploration process itself toward a coherent alignment with the firm strategy (Maniak, 2010; Midler et al., 2012).

This implies to manage and evaluate in parallel the triple impact of the project: (1) on direct profit, since the disruptive offer can eventually be a successful “blue ocean” market success (Kim & Mauborgne, 2004) (2) on firm resource and competences, since the project can be a commercial failure but provide a critical update on firm competitive advantage (Brady & Davies, 2004; Maidique & Zirger, 1985; Maniak & Midler, 2014) (3) on new exploration path discovery as project can be seen as transitory frame fostering competences redeployment (Charue-Duboc, 2007). Another issue with performance in innovation management refers to the paradox of local/global horizons of exploitation and exploration. Certain sustainable, disruptive and systemic innovations have local explorations, but for the firms they should be part of a global-scale deployment. A potential solution to such paradox has been suggested in the case of the EV, by embarking simultaneous explorations, in order to build different scenarios and drive a successful deployment by unexpected combinations (Charue-Duboc and Midler, 2011).

The above peculiarities of innovation management impacts also the processes of business model design, which must orchestrate firm’s action toward successful innovation deployment, and are per se an object of innovation. Business models can nowadays be perceived as “*schemas that organize managerial understandings about the design of firms’ value-creating activities and exchanges”*(Martins et al., 2015), and in the dynamics perspective of a trial and error process, they can enable knowledge transfer mechanisms from individuals to the organization (Sosna et al., 2010).

A second important element of the evolution of this stream of research is the increasing consideration of external players not only as classical “suppliers” or “partners”, but rather as “complementors” (Yoffie & Kwak, 2006) which have to co-invest upfront with the focal innovating firm. Each has to develop complementary assets and offers (Teece, 1986, 1996) so that the final offer takes benefits from various contributions. The focal firm can leverage both its existing assets and lines of products, incorporating ideas and expertise coming from a wide range of external contributors rather than only on internal forces (Chesbrough, 2003). It can also integrate a selected pool of contributors deeply and early in a given development project to incorporate their inputs in the DNA of a given project (Appleyard, 2003; Bidault, Despres, & Butler, 1998; Lamming, 1993). The relevance of external players in shaping production and strategic decision-making, drives to the criticity of the support mobilization within mitigated boundaries among them. The use of discoursive resources to achieve this goal in presence of such "political coalition" has been identified as key in the process of shaping players interests in the coalition driven by a multinational company (Whitford & Zirpoli 2016). The relevance of such resources, such as the creation of interlanguage among partners, is also recognized as key coordination factors through local sense-making generation in large scale innovative projects LSIP (Lenfle and Söderlund, 2018).

Engagement dynamics must consider that each organization involved in such partnership-driven project, has a dual agenda which keeps it onboard and investing: (1) feed its own strategic roadmaps & assets to exploit after / aside the collective project (2) contribute to the collective project in order to really build a successful and profitable common offer (Maniak & Midler, 2008; Segrestin, 2003).

It also appears that such systemic and disruptive innovation projects might involve industry transition and they challenge the alignment partners developed internally, but which is very often withholding the effective challenge of new technology or competition. How can the exploration and deployment of an innovation be harmonized? Ambidexterity as the ability to operationalize exploration and exploitation (Birkinshaw and Gupta, 2013; Duncan, 1976; Gibson and Birkinshaw, 2004; Tushman et al., 2010; Tushman and O'Reilly III, 1996) has been an answer to such challenge, although exploration coherence within large groups, evolution between exploration and deployment and governance still question academics. The ambidextrous ability to implement incremental and revolutionary changes praised by the literature had been studied considering one actor entering an industry but not in the perspective of ecosystem structuring.

From the perspective of the firm, it appears that innovation execution is more effective in organizational ambidexterity organizations, although the harmonization of exploration and exploitation appears to be linked to the locus of integration and the degree of structural differentiation (Tushman et al., 2010). Nevertheless, the capacity of building dynamic capabilities innovative features deployment on several product, it has been linked not only to the creation of Advanced Engineering units, but also to the fostering of coordination patterns through resources sharing between them and other units of the firm (Maniak et al., 2014).

Although positive links between ambidexterity and innovation performance have been extensively described in the literature, organizational ambidexterity has been found as inadequate in considering unexpected utilities emerging in specific situations such as contextual ambidexterity (Le Glatin et al., 2018).

Knowledge in unknown situations is a factor of success of innovation management as it might contribute to reduce risks and selection bias in the decision-making process, reducing the gap to the optimal choice (Le Masson et al., 2018). How can knowledge be better managed in a firm to foster innovation capabilities?

As far as the firm performance in case of radical innovation, knowledge enabling radical innovation can be fostered by internal corporate ventures for incumbent in mature markets (Maine, 2008), but if we focus in disruption consequences on innovation management, peculiar mechanisms to insure knowledge transfer from corporate venturing are needed (Stringer, 2000). But collaboration fostering among teams in the realm of unknown is a more complex problem.

The emergence of a proto-epistemic societies of experts within a firm has been observed as a governance of the co-extension of expertise fields to increase innovation potential toward disruptive innovation (Cabanes, 2017), and the lack of common area of knowledge among them has been linked to a deep re-organization of existing knowledge structures.

Table 1 Expertise governance for intensive innovation strategy

Régime d'émergence d'expertise	Potentiel d'innovation	Enjeux managériaux	Gouvernance de l'expertise		
			Modèle de coordination et d'action collective	Modèle de GRH	Rôle de l'expert dans l'organisation
Régime d'émergence d'expertise basé sur la cumulativité des champs d'expertise	Pas de révision de l'identité des champs d'expertise ➔ préservation des *dominant designs* Faible générativité de nouveaux concepts innovants et faible réorganisation des expertises Innovation incrémentale	Pilotage de l'innovation centré sur le développement de produits. Gestion de la préservation des structures d'expertises. Gestion de la création de connaissances dans un champ d'expertise déterminé. Coordination, collaboration et gestion de l'action collective des experts au sein d'un même domaine d'expertise. Reconnaissance du statut d'expert dans l'organisation.	Laboratoire industriel	Double échelle : filière technique et filière management	Développement de l'expertise au sein d'un domaine d'expertise. Expert ressource.
Régime d'émergence d'expertise basé sur la combinabilité des champs d'expertise.			Gestion de projet	Triple échelle : filière technique, filière management et filière gestion de projet	Développement de l'expertise au sein d'un domaine d'expertise. Expert ressource.
Régime d'émergence d'expertise basé sur l'absorptivité des champs d'expertise			Plateformes technologiques, architecture modulaire, communautés épistémiques, communauté d'innovation, open innovation	Double échelle, triple échelle, *open dual ladder*	Développement de l'expertise au sein d'un domaine d'expertise. Expert ressource. *Integration expert.*
Régime d'émergence d'expertise basé sur la co-extension des champs d'expertise	Révision de l'identité des champs d'expertises ➔ rupture des *dominant designs* Forte générativité de nouveaux concepts innovants et importante réorganisation des expertises Innovation de rupture	Pilotage d'une exploration d'un champ d'innovation focalisé sur de nouvelles structures d'expertise désirables. Gestion des réorganisations des structures d'expertise. Coordination, collaboration des experts de différents domaines d'expertises. Gestion et anticipation des degrés de transformation des structures d'expertise. Gestion d'une exploration d'un champ d'innovation ayant pour vocation de faire émerger de nouveaux champs d'expertise. Pilotage des processus de légitimation institutionnelle. Reconnaissance du rôle stratégique des experts. Gestion des ressources pour l'exploration organisée de champs d'innovation.	**Société proto-épistémique d'experts** **Modèle de coordination et d'action collective :** Pilotage d'une exploration d'un champ d'innovation focalisé sur l'émergence de nouvelles proto-expertises et sur la création de nouvelles structures d'expertise désirables. **Modèle de GRH :** La double échelle détermine les membres de la société proto-épistémique d'experts. **Rôle de l'expert dans l'organisation** : Experts stratèges en charge de piloter la restructuration des structures d'expertise afin d'augmenter la générativité de celle-ci.		

Tableau 37 : Régimes d'émergence d'expertise & gouvernance de l'émergence de l'expertise

Source: (Cabanes, 2017)

Such elements pushed the consideration of expertise management a step beyond absorptivity of expertise field. Interactions between individuals and the firm have been deeply assessed and identified as key part of the conception process, not just a resource of it. The angle of observation considered is within a given organization in intensive innovation situation, linked to firm's participation to technological platform. The evolution of the community among experts is set to consolidate in the organization. The analysis is focused on a specific procedure as a permanent component of a firm's processes and not as a transition object.

From a firm-centric perspective, we evaluate now the elements relevant to the dynamics of value creation when innovation is explored and exploited through the actions of several actors.

2.2.2 Innovation management across the value chain

A noticeable part of the literature took as a unit of innovation management not only the firm but rather an extended value chain. As consumers behaviors, regulations and corporate social responsibility started questioning organizations established processes in late 90ies, the involvement of suppliers in the management of a business activity based on customer demand became relevant to protect profits (Lamming and Hampson, 1996). This is possible with different schemes of cost and profit sharing.

From a supply chain vision of production management, firms moved one step forward in integrating their activities with suppliers, through the integration of the suppliers inside the innovation management models. The model of Co-development (Garel and Kesseler, 1998), called Early Supplier Involvement in the literature (Bidault and al., 1998; Handfield and al., 1999; Imai and al., 1985; Ragatz and al., 2002) is presented a priori as a privileged framework making it possible to innovate within a product development project. It associates the interior designer closely and several suppliers in the phases upstream, giving again degrees of freedom and making it possible to innovate on technologies, architectures (Bozdogan and al., 1998). This mobilization upstream makes it possible to increase the level of product quality and to reduce the times to market (Clark, 1989).

A further step toward activities sharing in a radical innovation process has been performed with the cooperation with suppliers aimed at knowledge generation as competitive advantage factor to be built together. The notion of Co-innovation (Maniak and Midler, 2008) is introduced as a specific typology of partnership, as shown in the Table here below:

Table 2 Differences between Co-development and Co-innovation partnerships

Co-development	*Co-innovation*
Small group of preselected partners	Opening of cooperation to those outside the traditional channels
Early, ongoing involvement up to the time of marketing	Early involvement, but with the possibility of stopping before the product is marketed
Invitation to tender based on the functional specifications of the components	Cooperation that focuses on priority value areas
Clear segregation of responsibilities: definition/attainment of performance objectives on components	Redefinition of the objectives and scope at each intermediary milestone
Ongoing, transparent interaction on project platforms	Interaction that is governed by intellectual property agreements
Direct returns on investments through the success of the new developed product	Business model partly founded on knowledge externalities

Source: (Maniak and Midler, 2007)

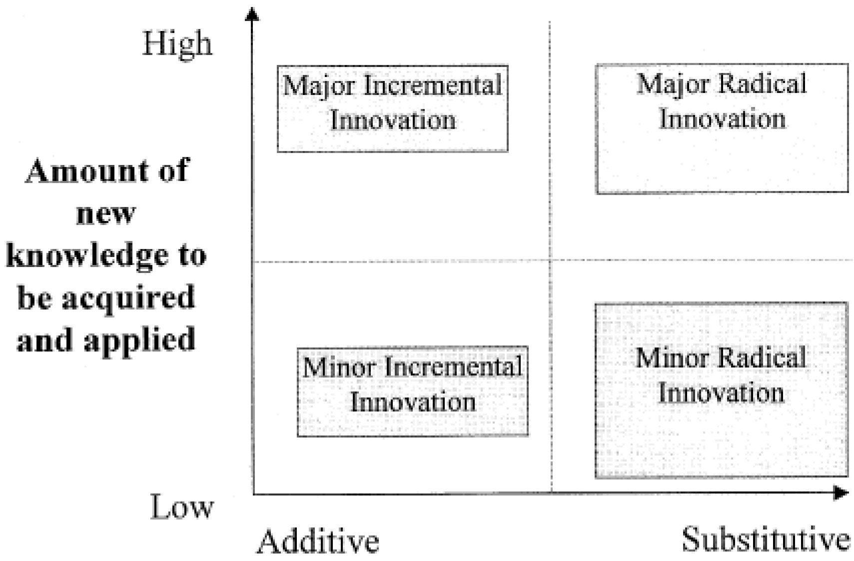
The emergence of new knowledge, as well as the evolution of cohesion sphere might be at the origin of exploration partnership among firms (Segrestin, 2003). Such partnership might be considered an innovation management tool; nevertheless at the beginning of their partnership firms experience unreliable conditions of coordination and cohesion.

Hybridization of offering (Shankar et al., 2007), enhanced by the digital technology, impacts the effectiveness of innovation processes; the combination of adequate resources and capabilities of supplier and manufacturer becomes a key element of innovation deployment (Ulaga and Reinartz, 2011).

Interfirm coordination mechanisms in a supplier-manufacturer value chain appear to be linked to actors' capabilities, choice on the degree of vertical integration, knowledge capital and strategic intentions (Cabigiosu et al., 2013).

Inter-organizational innovation requires the consideration of knowledge nature in order to understand which position in the competition firms can expect to have. The classification of knowledge nature relevant to value chain has been proposed by Hall and Andriani, as per the following Figure.

Figure 13 The nature of new knowledge



Source: (Hall and Andriani, 2003)

The link between innovation and value chain has been explored by literature, highlighting the relevance of high levels of collaboration practices to achieve better innovation activities, (Simatupang and Sridharan, 2005), including radical and continuous innovation (Soosay et al., 2008). Literature elucidates the risk of failure to bridge knowledge gap associated to the knowledge required to perform radical innovation is originated by the fact that the *substitutive knowledge,* involving un-learning new knowledge (Nooteboom, 1996), requires the difficult unlearning process (Hall and Andriani, 2002).

Choices are available for value chain participants to manage radical innovation, such as virtual teams (Malhotra et al., 2001) and structure their relationship as a "*network of interdependent Suppliers* » (Hall and Andriani, 2002).

Besides, innovation performance in the context of the value chain must also involve social considerations, as acquiring and assimilating new knowledge should not disrupt value chain members (Hall and Martin, 2005).

As roles in the value chain evolved due to the disruption of digital technologies and the supply/demand roles disintegrated, the value chain structure can nowadays evolve to add the consideration of direct or indirect competition and *transformers*, i.e. suppliers of complementary services (Chanal et al., 2011), notion known as value network in the co-opetition discourse (Nalebuff et al., 1996). Value sharing and capturing schemes in unstable environment should be analyzed by value chain participants from this perspective. In the case of start-ups, business models options identification might drive strategic choices, which will concretize firms action toward a different positioning along the value chain (Chanal et al., 2011).

The relevance of networks and the plurality of actors and conditions driving the value proposition definition drove us to the extension of the literature review on innovation management toward the consideration of the ecosystem perspective, which is developed in the following paragraph.

2.2.3 Ecosystem as the new locus for innovation management

The digital disruption enables platforms to deliver value propositions with an un-precedent level of systemic-ness in the offer side and of disruption in the demand side, in a value network frame. If the innovation of the product architecture, with no impact on the role of the incumbent in its traditional industry, already proved to be source of evolution of innovation processes, and challenges to traditional core competences within the organization (MacCormack et al., 2006), the disruption of digitalization o product and service experience, modifying the way users experience products, it questions company's the role within a value network going far beyond traditional industry. The relevance of platform renewal to go to emerging market has been stated for a firm involved in New Product Development (Meyer, 1997), and on such elements more recent considerations on the extension of platform dynamics and effects have been stated in relationship to innovation.

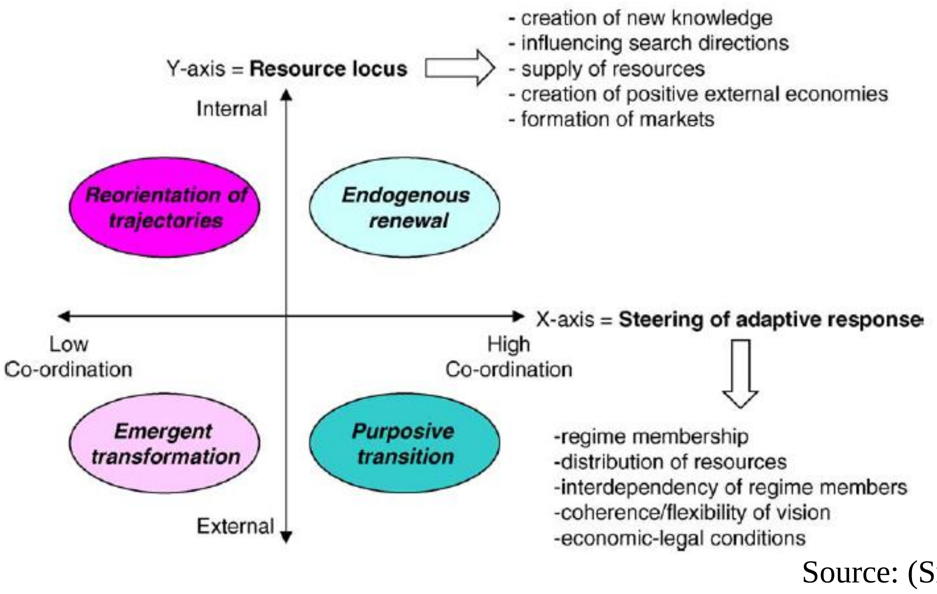
The successful deployment of innovation is enabled by the performance of identification of actors of the related ecosystem as well as the definition of distribution of value within the network (Chanal et al., 2011).

Continuous effort in pursuing innovation in technological domain can deliver the development of organizational capabilities, and it might represent a strategy for organizations to reach and maintain the leadership of a platform. *Platform leadership* is a structuring concept in our field of research interest as the leader influences the innovation in its industry through an increased weight over the network of firms and customers. In order to achieve such positioning in the network, the leader-to-be must embrace a broad vision of value creation and recognize that certain products have value only if connected to a network of complements. Therefore, in order to contribute to the value distribution for the involved network, the innovation effort must be supplemented by complementary innovations (Gawer and Cusumano, 2002). While exploring the coded theoretical frame for platform leadership in the case of technological transition such the digitalization of mobility, we found that the research focused so far on two analytical levels in terms of dimension of the observed situation of TT (Technological Transition). The frame was identified for specific cases, such as Intel and Microsoft (Gawer and Cusumano, 2002). The literature provides broad considerations on which factors allows a progressive technological transitions, such as the change of dimension of socio-technical regimes as part of the TT-derived configuration dynamics (Geels, 2002). Dimensions of such a regime vary depending on the TT and they need to align among themselves in order to successfully contribute to the TT. The relevance of changes in linkages and speed of them have been emphasized, as well as the role of social communities in variation of regime toward deep structure, stability and retention (Geels, 2002).

Therefore, in order to enable a virtuous circle of value distribution, innovation deployment in the context of an ecosystem must consider the socio-technical transition. Innovation management on ecosystem is linked to socio-technical regime viability (Walrave et al., 2017), but the process of ecosystem objects manipulation is not a "standard" management process. Challenges coming from the systemic and disruptive innovation present an unprecedented level of complexity, as they involve large changes in sociotechnical regimes dimensions, with unprecedented fast pace because linked to digital pace and not only industrial pace. Literature points out the relevance of public policies and regulators in the process of socio-technical transitions, as selection pressures nowadays include the actions of institutional structures and conventions (Geels, 2004), and the possibility to impact such transition is linked to the regime membership, the distribution of the resources for the change and from expectations (Smith et al., 2005).

Based on actors' coordination intention and locus of resources for the regime change, four transition contexts have been identified, as shown in the figure here below:

Figure 14 Transition context typologies



Source: (Smith et al., 2005)

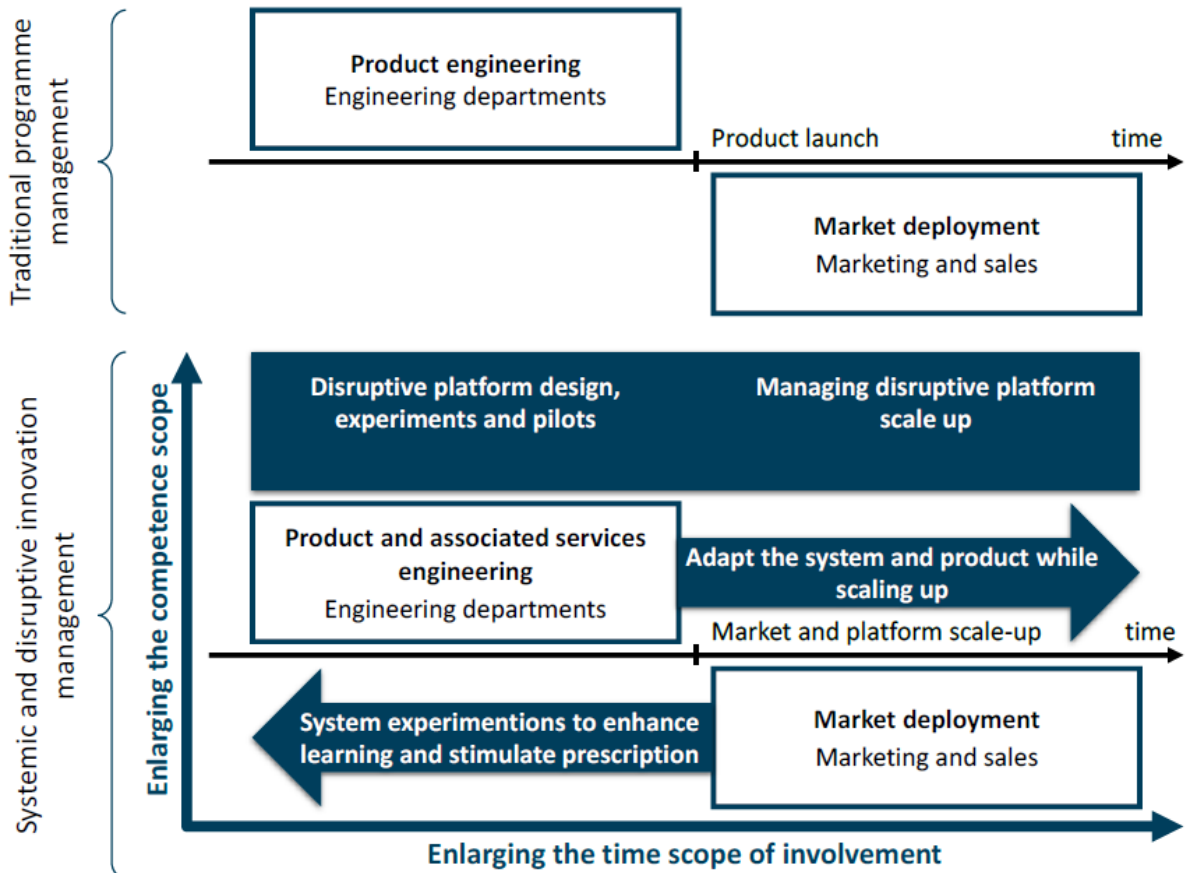
Systemic and disruptive innovation seems to be positioned in between Emergent Transformation and Purposive transition context. In terms of resources needed to response to selection pressures, we can affirm that the capabilities needed to explore such typology of innovation must be complemented by capabilities coming from outside the technological regime of incumbents. We are therefore in the External Locus of resources area, where structural changes of regime might happen. As far as the modality of actors' coordination for change, we are in between the co-evolutionary

model and the coordinated and governed one.
When approaching the connected mobility transition, and especially for electric autonomous vehicle, it appears that new networks of digital and physical facilities are needed in order to allow the technological transition to be delivered, confirming the need of structural changes of regime.
As far as systemic and disruptive innovation, literature provides elements on management to be performed by one single large company, as for the case of the indication of how it should manage EV deployment, considered as systemic and disruptive innovation (Von Pechmann *et al.* 2015).
But such innovations are part of the complexity of the overall environment; the concept of complexity can be characterized by the typology and dynamicity of interactions among sub-systems, which happen at different scale and at different speeds (Morvan, 2017).

Cities can be described by their capacity to innovate, as they represent local ecology of knowledge, in which heterogeneous entities generate new ideas through exchanges at different ground levels (Cohendet et al., 2010; Simon, 2009). Creative power of the city relies on the ability to move knowledge through layers; each layer has a role in the creative process of new knowledge generation, and on its transfer from an informal micro-level to a formal macro-level. Such knowledge flow associates our literature search to the paradigm of *open innovation*, as the innovation enabled by acting outside the boundaries of the firm (Chesbrough, 2003), for which innovation ecosystem represent a source of value creation increasing (Chesbrough and Appleyard, 2007). Through open innovation in projects development in an ecosystem structuring situation, organizations can also use the knowledge acquired during an innovation project in a program perspective, based on a multi-projects scale of deployment (Maniak and Marcocchia, 2018).
This tension between micro and macro, local and global levels could be balanced in the institutional environment, in which knowledge networks emerge and create the space for open innovation to spring from (Simard and West, 2006). Based on sustainable technology deployment case study, the role of micro-local experiences in innovation and the ecosystem structuring has been stated, as such experiences are linked to public policies and regulation evolution (Charue-Duboc and Midler, 2011).
The reflection on space for a certain typology of innovation to emerge appears to be the pertinent one to evaluate the role of ecosystem in the exploration and exploitation of systemic and disruptive innovation.
As far as tools for innovation management in ecosystem emergence, an input on tool deployment for the EV diffusion has been used. A business plan linking several actors with no hierarchical relationship has been deployed in the effort of generating a diffuse interest of complementors and customers (von Pechmann, 2014). Nevertheless, the pilot of the tool, Better Place, was not successful in generating by it the level of interest required to the project viability, with the

consequences we all know. The management of such innovation is revealed in its complexity in terms of competences, actors and timing, involving all departments within an organization with a different timing compared to the one established with traditional design, engineering and development process, as shown by the figure here below:

Figure 15 Systemic disruptive innovation management compared to traditional product development



Source: (von Pechmann, 2014)

Beyond the use of the business plan as tool to harmonize actors participation toward systemic and disruptive innovation deployment, literature highlights the role of innovation projects in external partners involvement and user experience progressive construction for Platform growth (von Pechmann et al., 2015).

Another element projects provide to the virtuous dynamics of partners involved in such typology of innovation if the generation of new knowledge, essential to both, internal growth of business units and external actors involved in the innovation exploration and deployment.

Such perspective is definitely helpful in our quest for systemic and disruptive innovation management guidance, and it deeply observes one actor. But how to steer the strategic decision making from the perspective of several actors and how to get them aligned and involved to reach the "timely manner" actions needed on von Pechmann's business plan model?

The nature (digital versus physical), the geographic extend (global vs local), the typology of industries involved (heterogeneous vs same or similar), a wider legal frame and unknown and multidisciplinary management practices characterize the different positioning among what has been studied so far. The width of the dimension makes the object a main factor for current and future social and institutional changes.

From the above elements, literature on innovation management elucidates which are the peculiar elements of it compared to New Product Development, especially related to perimeter of actions and partners' involvement. When organizations act to deliver the value proposition, their actions do not only comprise decision making on creation of new product or new services, but also the management of their assets. It is from project development that progressively organizations build their assets, and in case of systemic and disruptive innovation, assets' building happens in the context of networks and it has strategic implication for the organization positioning in the existing or emerging ecosystem. In the next chapter, we analyze the strategy literature to assess the key factor of successful decision making in case of systemic and disruptive innovation.

2.3 Strategy: perspective from firm to ecosystem

The second angle of literature analyzes the management from the strategy perspective. We dug into the literature taking a progressively widening lens as historically academic interest evolved from the organization as focus of strategic decision making to the inclusion of the overall environment as space for interrelated strategic decision making. Starting at the first level of analysis, the firm, we enlarge our literature cognizance by exploring the value chain context, in which strategic considerations must include the value creation dynamics emerging from outside actors in a supplier-manufacturer-customer interaction situation. Sustained by the evidences of empirical context assessment, industries' platformization effects in strategies are assessed from a theoretical point of view by questioning the literature on ecosystem as third and widest angle of literature exploration. From a macro view of players, their complementarities and the alignment dynamic, to the systemic deployment of interdependencies, we searched elements on partners' strategic decision-making in partners' alignment in current theories, tools and methodologies for successful strategy in systemic and disruptive innovation related ecosystems.

2.3.1 Strategy at Firm level

As a first level of literature assessment, we searched for the insights authors in strategy provided to managers in order to achieve a sustainable competitive advantage, from a competition based on production performances to the competition based on innovation.

2.3.1.1 The "seminal school of thought" for the firm

Management discipline inherited the characterization of strategy derived from the military art of defense. But as the internal and external challenges became more complex, the aim of defending the competitive advantage changed.

The art of defining objectives and methods to achieve them in war conditions evolved from the consideration of competitor's knowledge and their psychological domination and optimal resource deployment as key factors for a winning strategy, to the consideration of independent and specific situations and the relevance of frictions from un-forecasted events (Machiavelli; Tzu; Von Clausewitz, 1940) .

The management interpretation of strategy is more recent, and it was object of study after the Second World War. How to build a sustainable competitive advantage compared to competitors was the key question on the firm's strategy formulation path. From it, different approaches can be followed. Identification of the key elements of competitive-oriented strategy moved from the resources management to the collective action and knowledge management.

<u>Resources management as key factor for Strategy</u>

The link between internal resources and success of strategy was first highlighted by Penrose's work, on which the heterogeneity of services generated by the firm's resources were the source of the uniqueness of the firm (Penrose, 1959). The formulation of a successful strategy was then linked to the

consideration of such resources. Nevertheless the most diffused approach to strategy is the Porter's model (Porter, 1980) on competitive advantage acquisition through positioning of the firm itself and its products. The suggested focus for strategic decision making was on the firm's profitability through its position in its sector and on its market, with marginal consideration on its resources.

A few years later, the firm's performance in terms of profitability was questioned on a longer time horizon, introducing the focus on its sustainability. Sector, market and product don't always explain the successful performance of a firm, therefore a zoom on the influence of internal or acquired resources in profitability performance achievement was provided (Wernerfelt, 1984). For the author, firm's capacity in recognizing, acquiring and managing such resources determines an additional entry barrier, known as "*resource position barrier*".

But such consideration of resources was not sufficient to justify firm's success. In order to go further in the analysis of resources typology, core competencies were identified as the ones enabling the effective use of resources toward a competitive positioning (Prahalad and Hamel, 1990), as well as the coherence of strategic intent at the top of the hierarchy (Hamel and Prahalad, 1990). The path for complementing the strategy theory formulation with its implementation was then open, in a context in which modifications in global competition, customer expectations, regulation and technologies disrupted known paths and paradigms (Prahalad and Hamel, 1994).

In order to answer to the operational need of the transition between resource management and implementation toward sustainable competitive advantage, the identification of strategic resources has been studied, with the assumption of stable differences in resources' distribution among actors and a reflection on the characterization of firm's resources is performed on the basis of the notions of heterogeneity and immobility of resources. As a result, a new theory emerged, as Resource Based View of the firm and a model is proposed (VRIO) in the aim of discovering the unique resources and capabilities enabling a successful strategy deployment (Barney, 1995, 1991).

Focusing on the last part of Barney's model (i.e. the matching between resources and organization's structure and capabilities to exploit them), Durand highlighted the key impact of the organizational mechanisms deployment in strategy success. Strategists should then consider two dimensions of the organization, its structure and its culture for effective leadership of collective action in social representations toward the construction of reality (Durand et al., 1996).

A distinction is therefore emphasized between two phases of resources management: the selection and the exploitation (Makadok, 2001). In a first phase, managers should perform the selection of resources available, but under-evaluated by the market resource. As a following step, they should deploy such resources in order to generate dynamic and firm-specific capabilities toward a combined use of resources. Such process should provide organizational features difficult to imitate and to transfer, for a sustainable competitive advantage.

To build on the extension of competitive advantage building through use of resources, interconnection typologies among firms appear to impact on resource use performance more than the resource typologies (Lavie, 2006).

This is the reason why, from a resource management perspective, we address further inquiry in the literature by widening the angle to the value chain in a following paragraph, and we assess the interconnection by exploring emerging typologies of collective actions to complement the vision from an organizational structuring point of view.

As a complement to the above view of the strategy within an "established" view of the firm, we searched for academic analysis of new forms of strategic alignment toward shared results or performances.

Strategic collective actions as alternatives to established organization

We investigate what has been written about such emergence phase and we found elements related to collective action with no established organization (Wilhoit and Kisselburgh, 2015) and individual's actions toward the creation of an institution (Lawrence et al., 2002).

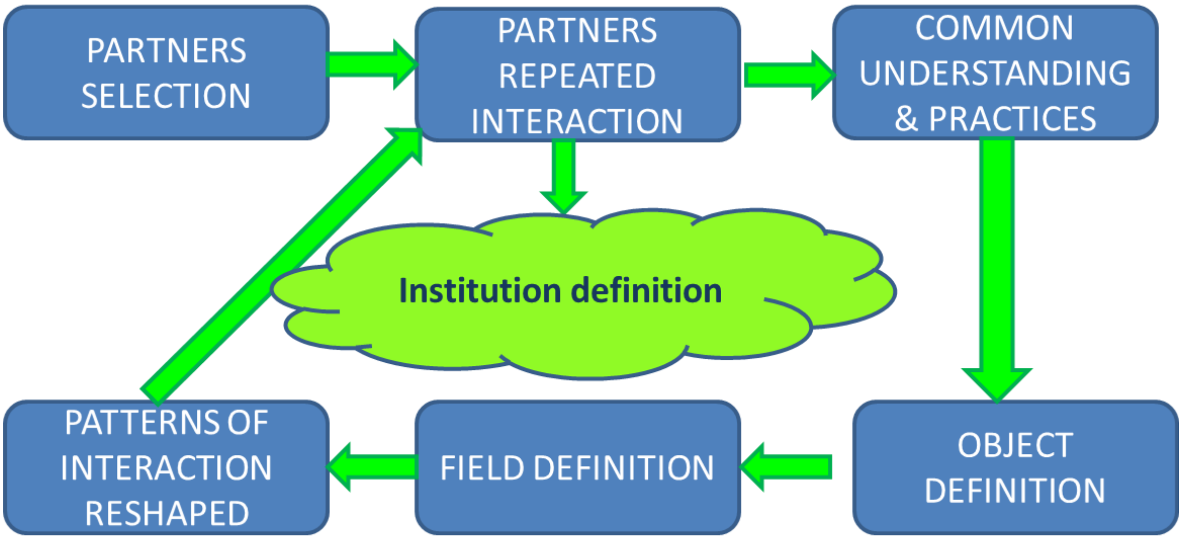
In the first case, taking a step away from established understanding of what an organization is, aggregation of individual activities toward a common goal appears to happen through communication when referring to proto-organization. In the case of a group of agents, achieving together and dynamically what could not be accomplished as separate actions is a process in which intentionality exist without formal definition or framing. The proto-step is relevant to better understand the mechanisms behind what formally will exist later. In this case, the motivation toward collective action is the personal concern, that can generate aggregation by coordination or communication in organizations (Bimber et al., 2012, 2005) or by simply individual acts and communications add up (Wilhoit and Kisselburgh, 2015). The relevance of material consequences as part of the process of structuring something (which links us to the relevance of using artefacts) is underlined. It is a confirmation of the relevance of the iterative process of structuring.

From the generative context formed by a collective action without organization, we then moved our interest toward the context of the generative context formed by repeated interactions among individuals.

The concept of proto-institution has been linked to repeated interactions, high level of involvement and embeddedness of collaboration among partners in order to achieve common understanding and practices (Lawrence et al., 2002).

Lawrence's process of proto-institution formation can be represented as follows:

Figure 16 The path of institution formation



Adapted from Lawrence et al. 2002

For Lawrence, repeated interactions drive to common understanding and practices, which form the object that define the field and parallel, these institutions reshape the ongoing patterns of interaction, influencing the formation of institution.

But in the article no information is provided in terms of partners' selection procedure for collaboration establishment, beyond the fact that partners shared the initial goal of providing a multidimensional problem solving scheme to nutritional issues. It appears that the idea of generating an institution is not part of the initial target of the collaboration among partners, but that the strong engagement and embeddedness into the institutional field might result in one.

Operational details on collaboration establishment, such as interaction starting event, or possibility to change number or typology of partners along the way, are not provided.

2.3.1.2 Strategy for the firm in realm of Innovation

Another stream of literature in strategy focuses on the firm and the implications of strategic decision making for innovation performance. From the above described competition arena, a new battlefield had been opened by the introduction of the technological perspective, as technological change can be a creative or a destructive force depending on the strategy firms apply (Utterback, 2004), and that innovation is "*a dynamic and strategic variable*" to firm's survival (Suarez and Utterback, 1995).

As the locus of innovation and the barriers to innovation are changing depending on the stage of development of the innovation itself, the competitive strategy of a firm was historically linked to the ability to dynamically orchestrate its efficient production and innovation capabilities (Utterback and Abernathy, 1975). Considerations on strategy toward production efficiency as a final development stage of innovation led to the definition of technologies as standards in an industry as the paradigm of *dominant design* (Abernathy and Utterback, 1978), whose emergence modifies the competitive environment of the firm (Suarez and Utterback, 1995).

Established strategic decision making, as to be the first to move for competitive advantage gaining, was challenged by the dominant design paradigm. In fast pacing industries, technology and commercial strategy decision making appeared to lead to different results depending on the moment of the decision making compared to the path of dominant design establishment in an industry and that observation of the convergence trend toward architectural standardization should lead overall strategic decision making for survival (Christensen et al., 1998).

As the typology of innovation can be defined by the link between the core and the components of a product or process (Henderson and Clark, 1990), and that architectural standardization implicates the standardization of interfaces and components (Ulrich, 1995), modularization (Baldwin and Clark, 2000) emerged as key element for strategic decision making.

Modularization can act as enabler of complex system management and enhancer of innovation performance of a firm, but the level of modularization might be designed with the awareness of the negative performance linked to excessively refined modules which prevent any local adaptation of innovative solutions (Ethiraj and Levinthal, 2004).

As modularization implies interfaces and complementarities redefinition among components, it impacts assets management strategies and innovation performances.

Performance and assets management

In the path toward assessment of the most effective path toward competitive advantage sustainability while facing changing external conditions within an industry, strategic decisions, such as investments in specific productivity innovation, have been linked to dynamicity of heterogeneity of rivals resources and capabilities (Hoopes et al., 2003), as well as managerial decisions and consequent business performance have been linked to specific typology of firm's capabilities, the dynamic managerial capabilities (Adner and Helfat, 2003). The performance on product innovation could then be assessed on the basis of the complementarity of the assets controlled by the firm as complementary components, distribution channels, production, service, etc (Teece, 1986), and on the basis of the consideration of the social capital (Tsai and Ghoshal, 1998). Social capital components, intended as structural, relational and cognitive (Nahapiet and Ghoshal, 1997), they dynamically interact to foster trust generation among business units and to deliver product innovation in a given firm (Tsai and Ghoshal, 1998).

The diffusion of systemic innovation, as product and process innovation requiring multiple interdependent firms acting and changing their processes, has been linked to the typology of interdependences among multiple projects (Taylor and Levitt, 2004).

As highlighted by this widening of innovation perimeter in the academic research, the increasing pace of technological change and increased market instability led to progressively shifting from a paradigm of a static view of assets, products and strategy to a more dynamic one. Discontinuity in technological trajectory might drive to the emergence of a new paradigm, as driven by interplays between scientific advances, economic factors, institutional variables, and unsolved difficulties on established technological paths (Dosi, 1982). On the assets side, the focus of a new paradigm is therefore more on the pace of transformation, than on the stability of them. The environment in which firms act is not taken as a given element to which firms can only adapt to, but as a factor on which firms can have an impact and can modify.

On the product side, the focus is no more on the protection of an established position and on very profitable businesses, but on the frequency of new products launch to generate long term profitability on the base of an extended product range satisfying a more segmented market.

This shift has been firstly recognized as an innovation based competition (Benghozi et al., 2000), intensive innovation context (Le Masson et al., 2006), hyper-competition (d'Aveni and Gunther, 1995), and time-paced competition (Brown and Eisenhardt, 1997). In such context, firms should not focus on current position protection, but rather on constantly improving and implementing proactivity, i.e. steadily attacking. The strategic perspective therefore shifted to assets building and exploiting, toward dynamic capabilities fostering ((Eisenhardt and Martin, 2000); (Teece, 2007); (Winter, 2003))

Management of capabilities becomes a fruitful field of exploration in unstable markets with rapid technological change. The characterization and the dynamics description of management capabilities of internal and external competences both drive to influential insights on how to steer strategy to identify new opportunities and to organize to capture them (Teece et al., 1997).

External environment perspective

Literature points out that, as an evolution step from the controlled environment of Porter's internal value chain in terms of innovation performance linked to strategic direction, firm's competitive strategy must consider also the external environment as a factor impacting innovation performances (Porter and Stern, 2001). New arena of strategic actions emerges as target for innovation-driven strategies. With the paradigm of the *Blue Ocean*, innovation contributes to the proposition of a value without precedent, toward the achievement of firm's brand value increase, cost reductions and later mass market adoption (Kim and Mauborgne, 2004).

But favorability of market conditions becomes a difficult factor to predict as far as strategic decision making is concerned. Strategic flexibility (Sanchez, 1995) and multiple-product innovation path for insight probing (Andriopoulos and Gotsi, 2006) have been specified as priorities in firm's strategy to overcome such instability.

Multiple product innovation has been described as driven by a balance between change and chaos; the simultaneous adaptation of product creation to changing markets and technologies is fostered by design freedom and broad communication with few, specific and clear structure and responsibilities in the process (Brown and Eisenhardt, 1997). Straightforward, simple guidelines are needed for effective strategic decision making (Eisenhardt, 2013), and simplicity is key to reach objectives over chaos.

Market uncertainty questions firms' assets and capabilities adequacy. The resource based view of the firm did not take into consideration the evolution of assets and capabilities under uncertain conditions. Among the capabilities to be fostered in a firm facing uncertain markets, literature highlights the heuristic process and knowledge management.

The heuristic process on one side, it appears to be related to better strategic decision making. Although the learning of heuristics has been identified in the action of experiencing something, with a specific order (Bingham and Eisenhardt, 2011), the performance of it in the strategic context has been particularly linked to coordination mechanisms among managers (Vuori and Vuori, 2014) in uncertain markets in which firms deal with numerous, but fast-paced and uncertain opportunities (Bingham and Eisenhardt, 2014).

As far as knowledge, we found elements in literature linking it to the value creation in an environment characterized by uncertainty and dynamism, as value creation is achieved also through knowledge, which is a key resource to develop and sustain competitive advantages (Teece et al., 1997). As part of the dynamic capabilities, knowledge management is part of the skill to continuously combine tangible and intangible assets (Teece, 2007).

Based on the above elements, the management of knowledge creation, transfer and application emerged as key capability for competitive firm; a new management concept rose.

The introduction of absorptive capacity

In this stream of approach (dynamic perspective), an organizational routines and strategy processes have been linked to the creation of dynamic capability linked to *absorptive capacity*. (Lane et al., 2006; Zahra and George, 2002).

Based on the seminal paper of Cohen &Levinthal, organizations seeking competitive advantage through innovation capabilities must foster the absorptive capacity, i.e. the capacity of valuing, assimilating and applying new and/or external knowledge. Such capacity at organizational level is linked to the interfaces of the organization with the external environment and to the transfer of knowledge among sub-divisions, and individuals part of them (Cohen and Levinthal, 1990). We can note that the notions of resource and competences evolved including a competence of information appropriation and comprehension, as key assets of an innovative firm. The individuals' contribution in such innovation performance dimension is relevant, as literature showed that individuals can become innovation catalysts when accessing to diverse knowledge through a closed network (Tortoriello et al., 2014), and that *knowing communities* are generated by their repeated interactions fueled by common interest (Harvey et al., 2015). Furthermore, the link between different skills within organizations modifies individuals' ability to influence expectation formation toward a more accurate prediction of technological potential advances in the market (Cohen and Levinthal, 1994).

Individuals are therefore key for integrating tacit and external knowledge in capability change and innovation performance of a firm. As far as tacit knowledge, capability changes of a firm can be seen influences by individuals' interactions performance, built on the wiring the cognition of humans to acquire tacit procedural knowledge (Kogut and Zander, 1996). Such knowledge is embedded in social relationship, it has an unpredictable path and it is influenced by the identity and the normative boundaries of a firm.

Individuals' ability to transform external knowledge for a firm's innovation capacity increase has been stated; it has been linked to their position in the firm internal social structure, especially when holding positions with a high concentration of structural holes of the internal knowledge sharing network (Tortoriello, 2015).

Social mechanisms appear therefore enablers of innovation-driven competitive advantage of the firm, as conditions for a firm to sustain a competitive advantage related to process and product innovation is achieved through realized absorptive capacity enabled by social integration mechanisms within the firm, and deployed with protection mechanisms to avoid spill overs (Zahra and George, 2002).

Once stated that absorptive capacity is an enabler factor for firms' competitive advantage in an innovation-characterized environment, the measure of a firm performance on such capacity appears key to strategic decision making.

Absorptive capacity evaluation can be done through appreciation of acquisition, assimilation, transformation and exploitation of external knowledge, as well as different managerial processes, organizational structures, knowledge about new markets (Camisón and Forés, 2010).

Such performance can be enhanced by peculiar external environments as in the case of cities for Knowledge Intensive firms (Cohendet and Simon, 2008), providing a specific knowledge fuel within the firm, and by the firms' interaction with particular actors in the city as the creative collectifs (Simon, 2009).

From the focus on the firm, we widen the scope of our literature review on strategy to the consideration of the impact of external actors contributing to the firm's activity.

2.3.2 Strategy from the firm to Value Chain perspective

As a second level of literature assessment, we searched for the insights authors in strategy provided to managers in order to achieve a sustainable competitive advantage, through the partnership creation and management with actors directly related to the firms' core business and activity flow.

2.3.2.1 The "seminal school of thought" for the Value Chain

A large literature in strategy also considered firms trajectories as dependent from upstream and downstream actors. This means to pay attention to both buyer-supplier relationship in order to optimize costs and cooperative attitudes, and also to the relevant typologies of alliances and allies to maximize value creation and collection.

Starting from questioning the origins of the buyer-supplier literature, we learnt that the relations buyer-supplier has been studied in relation to the methods of assessment, in particular of control of opportunism, of the supplier, within the framework of the theory of the costs of transaction and theory of the agency.

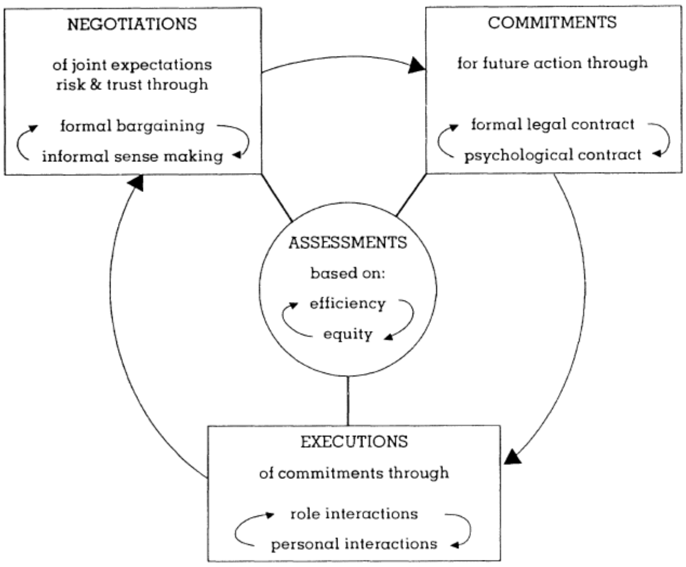
The costs of transaction (Williamson, 1975) indicate the costs of search of partners, negotiation and contract signature. The literature largely investigated the relations buyer-suppliers, while seeking to define the methods of incentive, coercion and monitoring making it possible to make so that each partner invests in the relation and does not use asymmetry of information to develop opportunistic behaviors (Baudry, 1993; Williamson, 1985). However, this literature relates to relations buyer-supplier where the contents of the exchange are defined and not in becoming. However the partnerships of R & D are by nature very difficult to even tally ex-handle, which increases the cost

of transaction drastically, returns the drafting of a “complete” contract impossible. This opens the way with various possibilities of handling in particular by the supplier (Neuville, 1998).
The relation of agency is a “contract in which a person (or several), called the main thing, resorts to the services of another person, the agent, to achieve on its behalf an unspecified task, which implies a delegation of decisional nature to the agent” (Jensen and Meckling, 1976, p.308). The asymmetry of information of this relation generates two types of problems then. Before the contract, the anti-selection characterizes the situation where the agent masks part of reality in particular to obtain the contract. After the contract, the behavior of the agent can not correspond to what was agreed. All this involves costs of monitoring: cost of systems design of incentive, information system allowing the control of actions etc.

This opportunism can be modulated by a more relational approach, which locates the transaction in a trajectory of medium term, an episode in a continuous social relation, bringing into play mechanisms like confidence or the reputation, avoiding opportunist behaviors of short-term (Larson, 1992; Rindfleisch and Heide, 1997). This approach of constitution of “panel of suppliers” was a practice generalized in the Nineties, which resulted in repeated preselection of the same list of suppliers.

In order to go beyond the above elements on transaction-based relationship, Richardson added the co-operation, based on the inter-connected nature of the organizations and the activities which are “*related to the discovery and future of estimate wants, to research, development and design, to the execution and coordination of processes of physical transformation, the marketing of goods and so one*” (Richardson, 1972, p.888).
The partnership is presented thus in the form of alternative coordination to the market and the hierarchy, which finds its justification in the fact that the activities of the companies are complementary and require a coordination. The origin of the cooperation among organizations can be found in heterogeneous conditions, such as existing relationships, institutional links, or resource dependence (Galaskiewicz, 1985; Oliver, 1990).
The process of giving structure to cooperation among organizations has been modeled, as reported in the figure below:

Figure 17 Process of development of cooperative InterOrganizational Relationships



Source: Ring and Van de Ven, (1994)

The hypothesis of such model is that the commitment to act is derived by the initial negotiation of appropriate, minimal expectations among participants, but they involve socio-psychological processes for the participants to make sense of the collaboration as "*congruency is a cumulative product of numerous interactions*" (Ring and Van de Ven, 1994).

Opportunities arising from the cooperation are defined as benefit (private and common benefit for the relative scope ratio calculation), although the relationship between benefit and value is not mentioned.

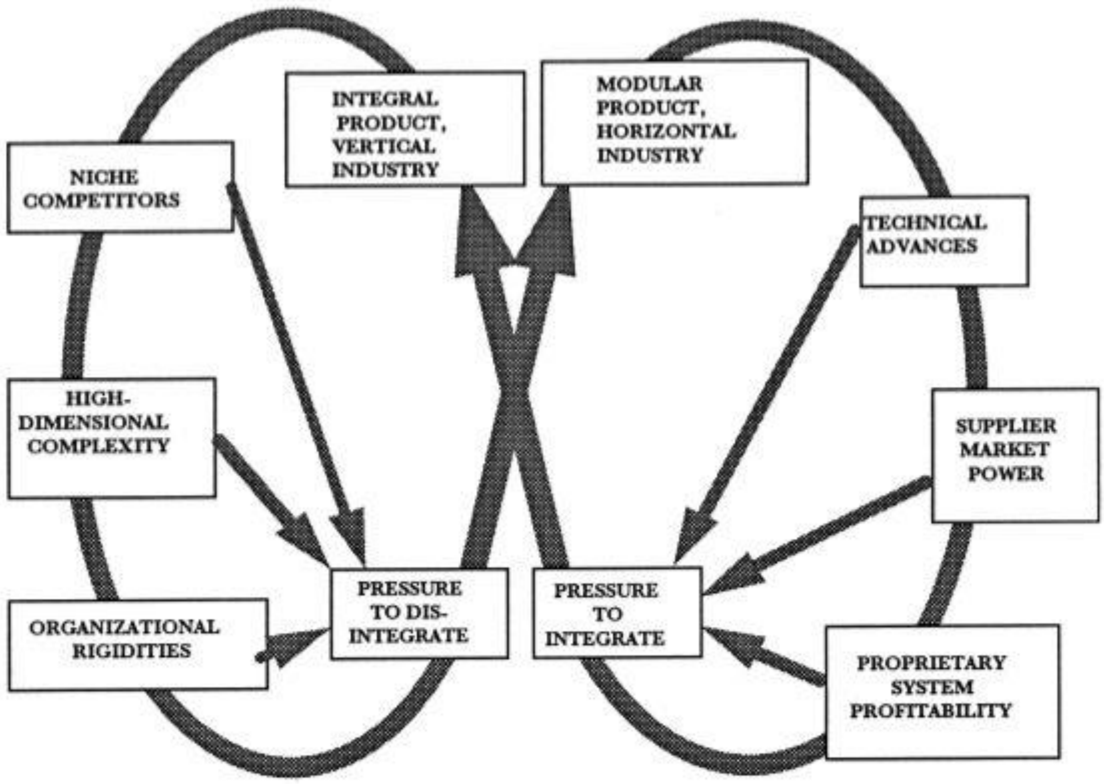
In the manufacturing industry, value chain strategy have been analyzed based on supplier-manufacturer dependencies linked to capacities and knowledge and inputs have been formulated on strategic decision making options linked to components' modularity (Fine and Whitney, 1996). Nevertheless, when the modularity is managed through outsourcing, systematic assessment of managerial decision is required in order to avoid poor architectural knowledge performance (Zirpoli and Becker, 2011).

In order to extend the characterization of resources toward meaningful selection for performance achievement, the process of creating and capture value in liaison with alliances, external resources and internal capabilities started to be explored (Bowman and Ambrosini, 2000; Doz and Hamel, 1998; Hamel et al., 1989).

From a static view of firm's relationship, literature evolved through a dynamic vision of the value chain. As introduced by Charles Fine (Fine, 1998), the strategic focus shouldn't be on a single company, but on the entire value chain dynamics, whose network needs to be carefully designed and coming changes and related capabilities fully understood. Dynamics between product architecture and industry structure are visualized on a helix, specific to an industry and on which all industries seem repeatedly conform to.

The Helix model of cycles of strategic decision making, alternating integration and dis-integration in an industry is presented below.

Figure 18 The clock-speed double helix



Source: (Fine, 1998)

The design of the supply chain is then identified as key to future performance of the firm in the above helix dynamics, but we are still in a context in which the value proposition is defined by one actor and no industry boundaries blurring are taken into consideration for the strategic decision of actors.

<u>Value chain performances</u>

As far as resource generation and management angle, several forms of connections to the external partners are nowadays available for firms to maximize their resource use. In case of alliances or venture, several combinations of decision making on resource management can be possible. Based on the seminal work of Gulati on inter-firm alliances for co-development or provision of good or technologies, we know that such networks generate new form of resources, source of strategic opportunities (Gulati, 1998). The path toward competitive advantage building might vary from industry and from number and typology of alliances. In the case of technology ventures, partners, often incumbent and entrepreneurial firms, they manage resources as power-balance game, on which resources needs, uniqueness of the resources, defense mechanisms and alternative partners' choices define firm's investment strategy in such ventures (Katila et al., 2008). An interesting perspective of how alliances portfolio choices can impact firm's performance has been provided in the case of portfolios' visualization in the context of an entire industry (Ozcan and Eisenhardt, 2009). The relevance of extending the consideration of an alliance in order to optimize strategic choices is also reported in markets portfolio consideration. Markets portfolio's overlapping among firms participating into an alliance, as well as the awareness of potential asymmetric incentives deriving from such situation can influence firms' behavior within the alliance, and the performance in building a competitive advantage (Khanna et al., 1998).

Literature highlights several positive contributions of alliances to firm's performances. Alliances are source of different performances in resources' alignment among partners, being alignment possibly characterized as supplementary, surplus, complementary, and wasteful, each impacting differently the alliance performance (Das and Teng, 2000). Das and Teng also related the alliance formation to the resources profiles of partners, highlighting that imperfect mobility, imitability, and substitutability of resources might lead to easier alliances formation. Alliances can therefore be a tool of competitive advantage generation as firms might be in a position to identify new business opportunities outside the alliance.
Alliances are also contributing to firms' learning in network context, as they provide information, which, when cumulated, might drive firms to generate new alliances through the network (Gulati, 1999). A network emerges from the rules generating the decision to cooperate, and firms extract value in participating to the network (Kogut, 2000). As reported in the automotive example analyzed by Kogut, the ignition factor for cooperation is the rent coming from coordination with suppliers, as enabler of time-to market reduction and production cost reduction. External network should provide firms with interconnections to others and access to heterogeneous, imperfectly mobile resources, but firm's relational capability will allow better performance in gaining and sustaining competitive advantage, if the fostered relationship is valuable and interactive (Lavie, 2006).

Alliances among competitors in the same sector, involving a limited number of participants, have proven to be effective in providing access to information on competitors through an unformal channel parallel to the formal alliance frame; the value of such information applies to the deepening of existing knowledge through sharing it internally (Hamel et al., 1989). The initial steps of assessing the strategic compatibility and the value creation logic of partners have been identified as the foundation of an alliance among few partners with identified roles within the same industry and a frame provided to assess alliance's benefits (Doz and Hamel, 1998).

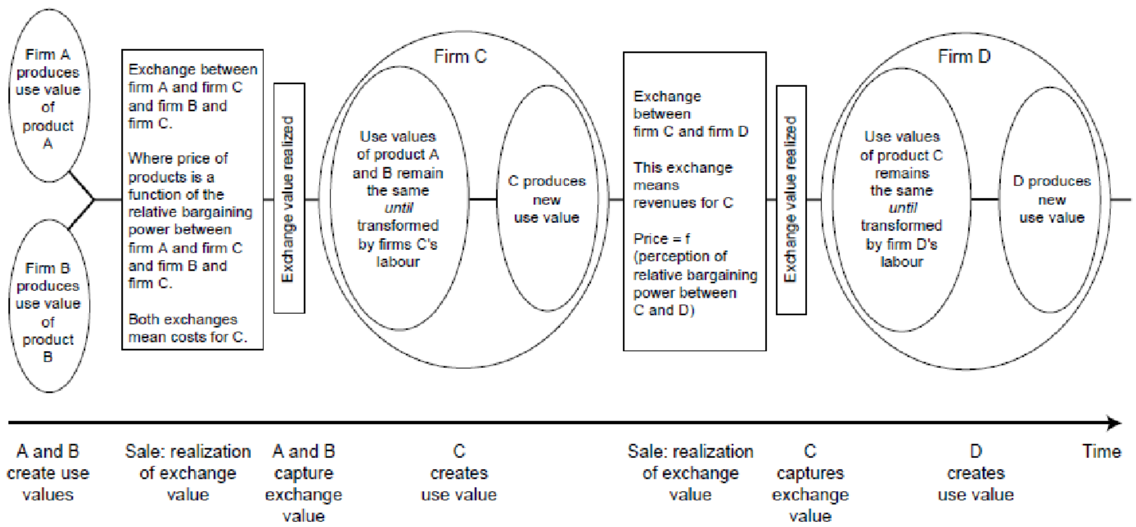
Based on Doz and Hamel logic, alliance's performance depends on the typology of alliance, and is not successful because it lasts, but because it contributes to the market definition, and it allows a shift in competitive strengths. The lack of emergence of new skills through the co-creation of new knowledge will impact heavily and negatively the alliance performance in the long term for dealing with uncertainty.

In a value chain context, we questioned how a firm can seek the sustainability of an alliance. Both, the role of heterogeneity in organizational labour (differential labour) in transforming so-called '*inanimated*' resources, as well as the power relationship among actors involved in the economic transaction (Bowman and Ambrosini, 2000), they should be considered for sustainable strategy for an individual firm in a buyer-seller relationship.

The source of competitive advantage is therefore inside the organization, "somewhere within the firm's transformation process" (Bowman and Ambrosini, 2000), and outside the organization, in steering the bargaining relationship between resources suppliers and the firm.

Based on the above consideration, a linear flow of value could be designed, when markets are considered unstable, but the process of use value creation is a linear sum of elements in which interactions are direct sales between two types of actors.

Figure 19 Summary of process of value creation and value capturing



Source: (Bowman and Ambrosini, 2000)

Another stream of value generated by alliances is the knowledge generation and capitalization. The learning process during a strategic alliance was described as sensitive to the setting of initial conditions of the alliance itself, to the interdependencies between learning in various dimensions. The alliance performance focus was set on actions such as clear definition of the task to be performed, routines coherent with internal organizational context of each participant, the design of interfaces between partners, and initial expectations of partners toward the alliance (Doz, 1996). Doz' assessment of performance relies on alliance efficiency and partners' equity and adaptability, which re-adjustment is dependent on the learning process kick off and development. A not too deterministic, not dominant, not well defined (rather too emergent) strategic context hampers cooperation, and therefore learning potential.

But as new interfaces emerge as the main driver for value chain disruption and reconfiguration (Jacobides et al. 2006), and platforms allow the capturing of the value created by these new interfaces (Gawer Cusumano 2003, 2014), strategic challenges evolves rapidly, and impact the design of the value chain as well as of the organization structure, making it an on-going process as well as a firm's core capability (Fine et al., 2002). This context impacts also the learning output for value chain participants as well as the factors driving it.
Let's explore the value chain from the innovation perspective.

2.3.2.2 Strategy in a Value chain and Innovation paradigm

As product innovation has been detected as one factor leading to competitive advantage (Koufteros et al., 1997), the supply chain management (SCM) has been characterized as one among organizational practices impacting product innovation and therefore influencing organizations' competitive advantage performances (Li et al., 2006). Strategic supplier partnerships become the focus of competitiveness-seekers' agenda.

<u>Contribution of strategic decision making on value chain to innovation performance</u>

Partnerships can contribute to innovation performances, and therefore competitiveness of a firm, in several ways. If we consider technological alliances for instance, they can provide resources exchange and social status recognition among customers or other partners, based upon resources profiles of partners (Stuart, 2000).

Another significant impact of alliances concerns their role as enabling firms to achieve better performances in knowledge management. Literature elucidates alliances contribution to external knowledge application through integration and utilization of it within a firm participating to an alliance (Grant and BadenFuller, 2004).

New knowledge assimilation in R&D alliances and in international joint ventures has been linked to similarity of business, problems and priorities, organizational structures and dominant logics among participants; trust appears not to be driving the learning performance (Lane et al., 2001; Lane and Lubatkin, 1998).

Strategic alliances and value capturing have been studied from the alliance governance angle. Governance choices appear to be linked to appropriation concerns, linked to firm's ability to capture a fair share of the value created by the alliance, and this capturing ability is related to the uncertainty of future specifications, costs and identification of partners contributions (Gulati and Singh, 1998). Alliance partners try to frame by governance their reluctance of ongoing need of mutual adaptation and adjustment related to activities composition and interaction. Uncertainty in this study is associated to existing elements.

One way to frame this reluctance might be to enter into repeated equity-based alliances, but literature warns us on the potential negative consequence of such partner choice repetition as, in case of technological uncertainty, firms performance might be diminished (Goerzen, 2007).

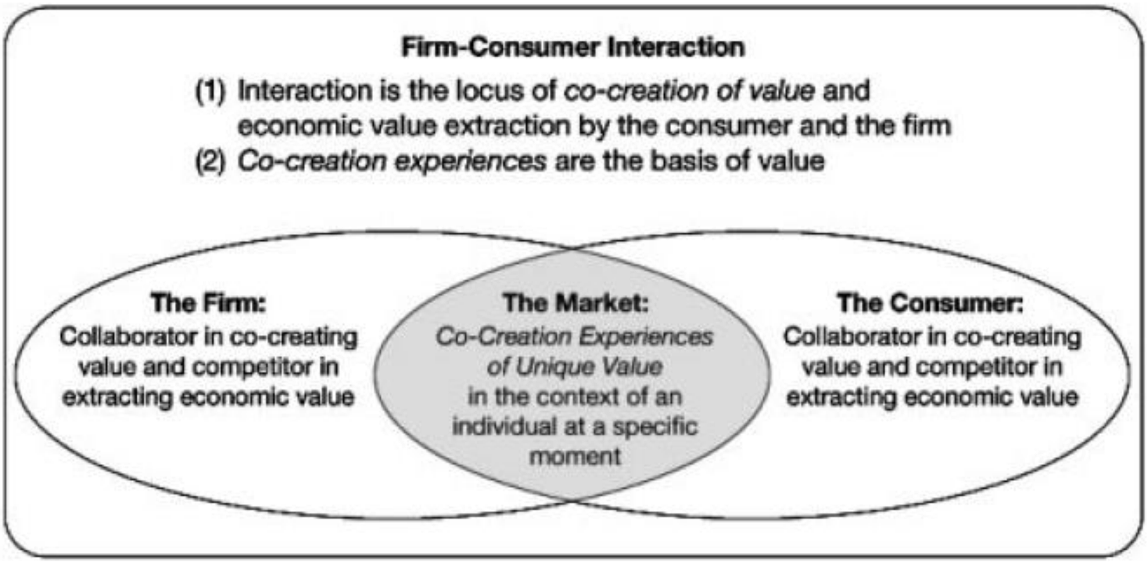
Uncertainty of external factors can therefore disrupt value chain positions of partners, and more complexity is added to strategic decision making. Along with the consideration of the value flow, systemic innovation was recognized as disruptor in terms of value chain positioning, as it implies significant transformations of the role of certain actors along the value chain, from suppliers to service providers (Afuah and Bahram, 1995).

<u>The progressive extension of the chain</u>

Furthermore, the digital technology deployment imposes a revision of the strategy approach as well as an empirical relevance on it in order to comply with the actual complexity of the context on which organizations operate. The perspective on the value chain evolution has to be widened by involving the connected and empowered consumer into the process of creating the value proposition as enhanced experience for him. From firm centered to customer oriented, the degree of future user's involvement into the value proposition definition process might vary. The interaction between the firm and the consumer is the locus of value creation and capturing, and co-creation as process of joint problem definition and solving through active dialogue in an experience environment, it appears to be the path toward performant interaction (Prahalad and Ramaswamy, 2004a) and competition winning (Prahalad and Ramaswamy, 2004b).

Market is therefore co-defined by firms and consumers, as shown in the figure below:

Figure 20 The emerging concept of market



Source: (Prahalad and Ramaswamy, 2004a)

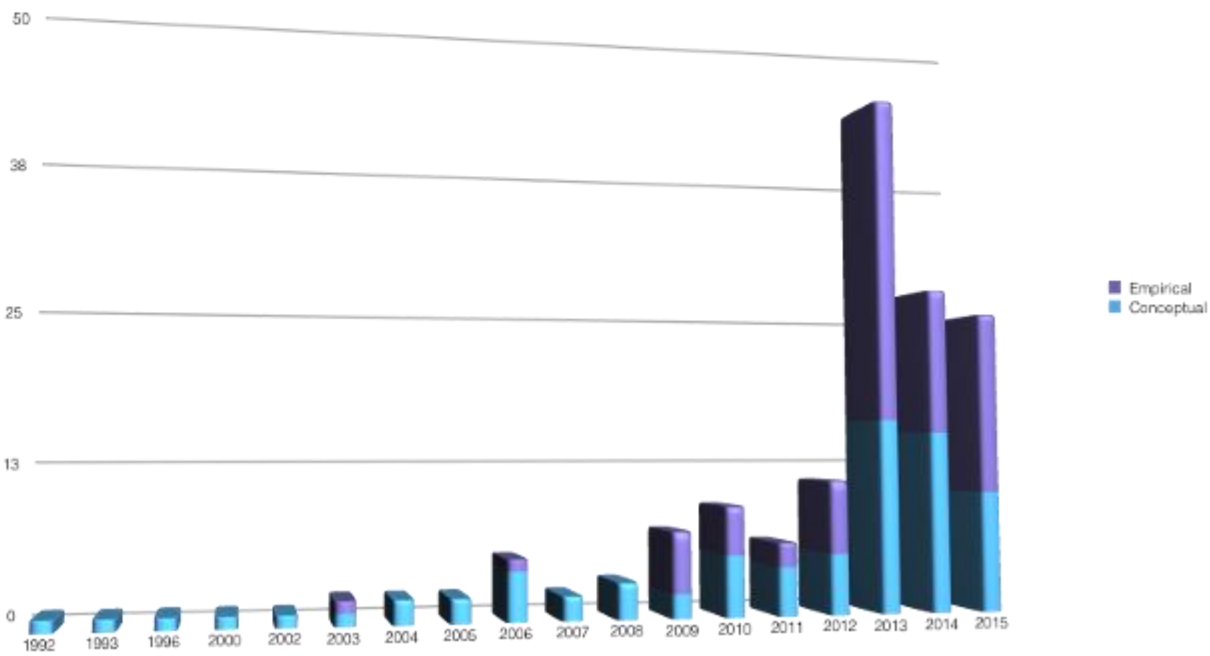
As we can note, the value creation logic evolves. The extension of actors to be considered as part of the value chain and involved in the value proposition design in systemic and disruptive innovation pave the way for the consideration of value networks as the next step of analysis for strategic decision making for creation and collection of value, especially in cases where digitalization impact supply and demand chain (Peppard and Rylander, 2006). Value co-creation is taken to a wider horizon, and we therefore question the realm of ecosystem as the next step of our journey into strategy literature.

2.2.3 Strategy from Value Chain to Ecosystem perspective

As found in existing literature on this topic, a new form of competition appeared, in which "*companies co-evolve capabilities around a new innovation: They work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations*" (Moore, 1993).

The relevance of the ecosystem-drive perspective for strategic decision making has been supported by the increasing amount of academic production on the subject, as shown by the graph below:

Figure 21 Ecosystem articles in social sciences literature



Source: (Jacobides et al., 2016)

Taking these elements into account, we expanded our review from value chain to the literature related to strategic management of ecosystem.

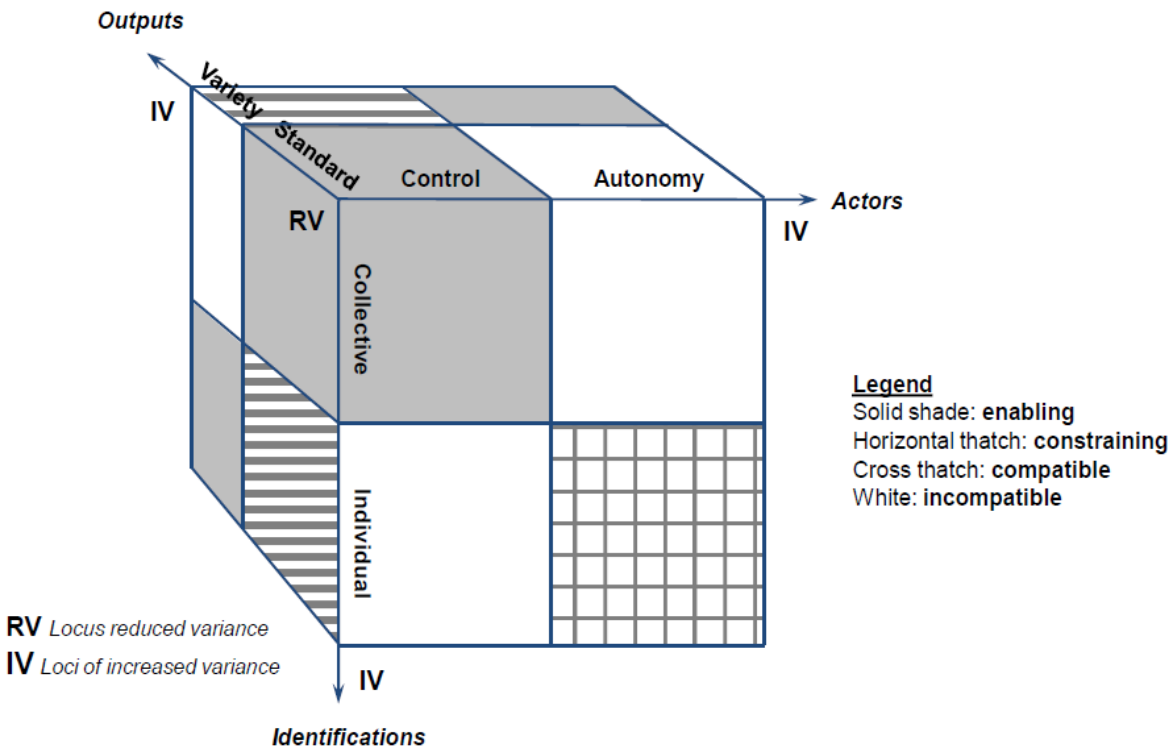
3.2.3.1 The seminal school of thought on strategy and ecosystems

Since the proposition of the *business ecosystem* concept (Moore, 1993), several authors contributed to the management of it in regimes of rapid technological changes, by setting the impact of dynamic capabilities into existing ecosystem's shape (Teece, 2007) and in value capturing through organizational renewing (Katkalo et al., 2010), and by highlighting the influence of core firms into complementors trajectory (Pierce, 2009). Besides the speed of technological change, the interlinked technologies comprising a platform involve the set of platform complements developed by independent firms (Gawer and Cusumano, 2002).

"*Co-evolution and complex interactions*" among participants, are already mentioned as key part of business ecosystem management, but participants are not linked to an industry, but to a community of organizations, institutions and individuals impacting a linear chain of supplier-manufacturer-customer (Teece, 2007). The framing of participants' interactions evolved toward collaborative arrangements between a core firm and providers of complementary products (Adner, 2006; Adner and Kapoor, 2010; Kapoor and Lee, 2013).

The existence of paradoxical tensions among technology ecosystem's participants has been observed (Wareham et al., 2014) and represented as follows:

Figure 22 Tensions across output, actors and identifications



Source: (Wareham et al., 2014)

Ecosystem governance can solve simultaneously such individual and plural paradoxes and achieve a general outcome.

Ecosystem general outcome as value delivery

Such considerations drove us to the assessment of ecosystem encompassing the several definitions provided by literature, but concentrating on how the ecosystem as a network creates and delivers value, and how value is appropriated by the actors in it (Adner, 2012; Thomas et al., 2014; Williamson and De Meyer, 2012).

Value creation and value capture empirical link within ecosystem contexts has been described (Adner and Kapoor, 2010), and elements key toward it identified (Autio and Thomas, 2014). Players who control the architecture and interfaces of the final offer are in the best position to capture most of the value created by an ecosystem, which stands as a great incentive for certain firms to become and remain platform leaders (Jacobides, 2006; Jacobides et al., 2016, 2007).

Ecosystems might present linear or not linear value creations processes, as shown for existing knowledge and business ecosystems (Clarysse et al., 2014). Nevertheless, value creation and capturing strategies become complex and related to the role firms decide to play in the ecosystem (Jacobides et al., 2006; Jacobides and Tae, 2015) as firms are becoming aware of the widening of the related ecosystem (Adner, 2017) and that ecosystem participation might generate specific costs (Claussen et al., 2013; Kapoor and Agarwal, 2017) not easily fungible elsewhere in organizations.
Value creation and capturing in an ecosystem cannot be considered without mentioning the business model of the platform at the base of the ecosystem. It can be interpreted as a network-oriented extension of the *business model* concept that specifies the value logic for an individual firm (Adner, 2016; (Osterwalder and Pigneur, 2010; Zott et al., 2011), as business model is nowadays designed along with the definition of constitutive elements of the ecosystem (Jacobides et al., 2018). As far as business model concept, the network oriented extension involves organizations at different levels, as they have to operate trade-offs between overall decision coordination and the specificity of professional adaptations to personal information (Hagiu and Wright, 2015).

Furthermore, developing value in the ecosystem context is difficult for the choice on the complex system building options, as the perspective needs to include the demand side of the platform (Massa et al., 2017).
The structuration of the ecosystem becomes the next area of ecosystem literature assessment.

<u>The emergence of an ecosystem</u>

The need of a maturation process from emergence to stabilization and renewal of an ecosystem has been stated (Moore, 1993), but the phase of creation of these arrangements and interdependencies is still quite underexplored, as the role of organizations structure on such phase, potentially impacting ecosystem design and value creation. Focusing our ecosystem assessment on value creation and interaction among partners, two elements appeared to us more relevant in the realm of structuring ecosystems. Ecosystem formation needs the interaction of multilateral partners in order to jointly create a concrete value proposition, and for this scope it is an "*alignment structure*" (Adner, 2017). On the partners' relationship side, the relations among partners are defined by "*nongeneric"* complementarities, not controlled, but to be coordinated without vertical integration (Jacobides et al., 2018). It appears that initially key actors experience misalignment as far as goals and intentions in order to accomplish a common ecosystem value proposition (Casadesus-Masanell and Yoffie, 2007; Sharapov et al., 2013). Platform leadership actions demonstrated as key toward incenting complementors to invest upfront, building together a growing disruptive market (Gawer and Cusumano, 2014).

In IT open system architecture, establishing a competitive success is achieved by controlling the platform through the definition and proprietary detention of standards of the information package assembly (Morris and Ferguson, 1993), with the warning that heavy investments on continuous product improvement are needed, and architecture must be conceived as expandable to satisfy progressively more general-purpose consumer systems, and alliance setting should be easily changeable.

Ecosystem design appears to be kicked off by modularity, nature of complementarities among partners and fungible investments, on one side, or by unintended process by firms involved in modular technologies (Jacobides et al., 2018). Authors clearly identified that potential ecosystem members' investment relies on strong incentive mechanisms. That's why the identification of intermediaries and complements, as well as analysis of costs and benefits for intermediaries are set as key steps for ecosystem to take off (Adner, 2006).

<u>The effects of position</u>

Challenges for mastering the positioning in a given ecosystem have been identified, as well as the distributed creativity as the capability to master them (Moore, 2006). Ecosystem viability has also been linked to value proposition and ecosystem model modification based on the reaction of the socio-technical regime (Walrave et al., 2017). Ecosystem position and viability should also consider specific strategies of price settings, based on the consideration that, if market exhibits cross network effects, then platforms should strategically set their prices, taking in account the fact that a larger number of actors on one side of the market (i.e the consumers) may attract more actors on the other sides of the market (i.e the sellers) (Armstrong and Wright, 2007; Caillaud and Jullien, 2003; Rochet and Tirole, 2003).

Business ecosystems can be a tool for complex adaptive business environments, but in order to be performant, participants shall invest in R&D and adopt an absorptive innovation strategy (Peltoniemi and Vuori, 2004). Absorptive capacity in innovation ecosystem appear linked to the width and the depth of openness degree for maximizing knowledge acquisition and exploitation (Sun et al., 2015).

Let's shift now the analysis lenses from ecosystem global overview to the impact of ecosystem strategy in a context of innovation.

3.3.3.2 Strategy in the realm of ecosystems and Innovation

As new competition takes place in an environment encompassing the boundaries of a single industry, firms are no more actors of a single industry, but players of one or several ecosystems.

Strategy must nowadays consider wider scope and stakeholders' list, and refer to a specific ecosystem typology based on the field of application (business, innovation, platform) (Iansiti and Levien, 2004a, 2004b). Organization's strategy and innovation processes are impacted by the dynamics of the business ecosystem organizations are part of (Iansiti and Levien, 2004b).

Literature provides insights on innovation ecosystems salient objects and links to be considered from a strategic decision making perspective, such as the ecosystem value proposition (EVP) and the ecosystem model (EM) (Walrave et al., 2017), actors interdependencies (Adner, 2006) and value distribution among them (Autio and Thomas, 2014).

As far as elements to be considered for the ecosystem design perspective, the fact that the EVP is related to a joint statement of the performance to be achieved, and it is defined through interactions from the end-users perspective as starting point (Walrave et al., 2017). The second object, the EM, can be intended as a structure of a network that creates and deliver value, and a process of value appropriation (Adner, 2012; Thomas et al., 2014; Williamson and De Meyer, 2012).The value logic of an individual firm sustaining a business model (Osterwalder and Pigneur, 2010; Zott et al., 2011) is then extended to the network of interdependent actors (Adner et al., 2013), and the reaction of EVP and EM to socio-technical environment could improve the ecosystem viability (Walrave et al., 2017).

Systemic innovation challenge also requires that players align their output to construct offers which make sense together (Gawer and Cusumano, 2002; von Pechmann et al., 2015). The deployment of highly systemic and disruptive innovation appears then linked to socio-cultural, economic and legal frames evolution, as already described for sustainable technologies (Kemp et al., 1998). In this context, the relevance of dynamic alignment of private and public actors for systemic and disruptive innovation management has been clearly identified (Pinske et al., 2016).

Systemic disruptive innovation implies a large landscape (Kemp and Rotmans, 2005) for technological transition, and the contribution of different players and of various mechanisms of variation, selection and retention are needed for technological transition (Geels, 2002). Recent use of the notion of ecosystem has been intended to represent systemic innovation challenges, where a collaborative form of value creation involves heterogeneous partners. In this case, the requisite of sense-making process goes beyond offer construction, as it is necessary toward partners' engagement into ecosystems, as stated in the case of entrepreneurial ecosystems (Autio and Levie, 2017).

How are emergent disruptive technology and ecosystem dynamics linked? When in presence of technological innovation, the consideration of the dynamics of the ecosystem in which new focal technologies emerge are key to understanding users' adoption when technology is the bottleneck of

the system (Adner and Kapoor, 2016).
A key element of the ecosystem has been identified in the presence of a focal firm or platform around which the stakeholders interconnections are set (Autio and Thomas, 2014). But the characterization of ecosystem as structure linked to "*the multilateral set of partners that need to interact in order for a focal value proposition to materialize*" (Adner, 2017) seems more relevant to questioning the phase of ecosystem emergence, in which positions are not set yet, and they might evolve depending on the strategic choices stakeholders perform. Partners do not start with the same interests in terms of value capture, and with the same perspectives in terms of value creation and distribution. Such positions destabilize the offer system.
Furthermore, when considering systemic innovation, actors interacting in the related ecosystems can be classified in three main sectors, the private, the public and the plural (Mintzberg, 2016), adding the relevance to the communities in the process of getting a healthy and balanced society, as an evolution of the so far intended output of interplay of public and private sector in the value proposition creation process.

The high uncertainty in offer and demand evolution while structuring an ecosystem reinforces such proposals. Different management tools are needed to master a highly uncertain environment, as well as the building strong dynamic capabilities to foster the essential organizational agility linked to such environment (Teece, et al., 2016). Focus is on the materialization of the value proposition, as the process of bringing evidence of what has been previously defined. From literature, it appears that value proposition is set and does not change during the process of instantiation.
Sustainability of the ecosystem, linked to its purpose of long-term value creation, has been rooted into partners' qualities and attributes (innovation commitment and readiness) (Moore, 1993).
The identification of the value sharing model becomes crucial to companies' survival, and nowadays authors agree on the need of a specific management approach in order to align all organizations, synchronize them, in order to streamline a consistent value sharing model (Gawer and Cusumano, 2014; von Pechmann et al., 2015). The deployment of the innovation on which the ecosystem is based is achieved through the external development of the ecosystem (Walrave et al., 2017).
Coordination among interdependent activities, achieved with specific governance, enables the consideration of the demand side and it is key to competitive advantage achievement in an established business ecosystem of a single industry (Kapoor and Lee, 2013).
A frame of approaches to interdependencies has been provided by Adner, as follows:

Table 3 Approaches to interdependencies

Construct	Core Issue	Classic Example	Outside of Scope/ Missing Element
Platforms (e.g., Gawer & Cusumano, 2002; Parker et al., 2016)	Access, incentives, and control with focus on technology	Intel	Interdependence is not always platform based. Whereas platforms are concerned with the governance of interfaces, ecosystems are concerned with the structure of interdependence.
Multisided markets (e.g., Hagiu & Wright, 2015)	Access, incentives, and control with focus on transactions	e-Bay	Multilateral arrangements that do not have a broker role; contestability roles among partners. Indirect links.
Networks and alliances (e.g., Gulati, 1999; Powell et al., 1996)	Observed patterns of connectivity	Biotechnology alliance networks	Explicit design and alignment strategies; flow of value—who hands off to whom (vs. collaborating on invention; building on knowledge); focus on specific value proposition.
Business models (e.g., Osterwalder et al., 2005; Zott, Amit, & Massa, 2011)	Plan for value creation and capture for focal firm	Zipcar	Indirect links among partners; boundary logic; necessary consistency of models across all partner firms.
Project management (e.g., Kerzner, 2013)	Coordination of project members and components	Construction site	Presumption of hierarchy and exogenous appointment of project leadership roles. Mutual recognition and agreement among members that they are involved in same the project.
Supply chain and value chain (e.g., Porter, 1985; Simchi-Levi, 2005)	Make vs. buy decisions; bargaining; partner reliability	Toyota	Partners off the critical path; multilateral dynamics; alignment strategies.
Industry structure (e.g., Bain, 1959)	Nature, sources, and management of rivalry	Airlines	Specifics of value creation; innovation and changes to the industry value proposition.
Industry architecture (e.g., Jacobides, 2005)	Vertical division of labor	Mortgage banking	New dependencies that arise and lie outside the traditional value chain.
Value net (e.g., Brandenburger & Nalebuff, 1996)	Competing with complementors	DeBeers; Nintendo	Structure: how the arrangement of actors affect value creation and value capture.
Systems of technology (e.g., Hughes, 1993)	Social and technological dimension of systems; bottlenecks	Electrification	Absence of explicit structure.
Open innovation (e.g., Chesbrough, 2006; von Hippel, 2006)	Sources of innovation; governance and quality of communities and participants	Xerox; Linux	Integration of multiple actors; multilateral dynamics.
Value net (e.g., Christensen & Rosenbloom, 1995)	Lock in to cost structure of supply chain	Disk Drives	Dynamics: the emergence and evolution of the network.

Source: (Adner, 2017)

As shown in the above frame, the emergence of ecosystem, the dynamics of partners' alignment, being heterogeneous and with different (sometimes diverging) interests and related impact on value creation are still open questions for the strategic field. Recent literature provides partial answers to such questions.

The phase of ecosystem emergence has been recently investigated by literature and it provides hints on general challenges (Sharapov et al., 2013), characteristics of a specific typology of ecosystem (Autio and Levie, 2017), and value creation and capturing path (Hannah and Eisenhardt, 2016), moving toward the emergence of a theory of ecosystem (Jacobides et al., 2018).

In the case of nascent ecosystems, a study on solar panel industry shows that there are different strategies to navigate such situations and the path to bottleneck position is described as the one

enabling the creation and capturing of value (Hannah & Eisenhardt 2016). The bottleneck is identified as segments where mobility is limited and competition softened (Jacobides, 2006), and the conditions for the emergence highlighted by the study are undefined industry structures, unclear products, missing ecosystem components, lack of clarity on who participates and why, and rapid innovation in one or more components (Hannah and Eisenhardt, 2016).
The ecosystem creation has been framed on a 2-step process during which participants build attractiveness of the ecosystem through cognitive legitimacy, and they achieve external acceptance and support through sociopolitical legitimacy (Sharapov et al., 2013).

Recent literature provides relevant insights on the characteristics of entrepreneurial ecosystems in entrepreneurial context linked to digital technology (Autio et al., 2017).
The lack of resources for entrepreneurial firms should be the ignition factor for effective strategy pursuing (Hannah and Eisenhardt, 2016), but it depends on which resources we are referring to. There might be resources of which entrepreneurial firms are far richer than incumbent, making them more suitable to navigate nascent ecosystem (i.e. it is not the lack of money that makes automatically an entrepreneurial firm more effective in its strategy definition compared to an established one, but a set of characteristics, including mind set, business approach, risk tolerance etc.). The analysis was done a posteriori on one industry, not while the ecosystem was under creation through the participation of several industries with technology not well described but under development and not defined customers (users-use cases).
So far, elements on nascent ecosystems arise from case studies on entrepreneurial firms, in sectors with no incumbents, for a sector emerged several years ago, related to one industry, with main obstacles in technology application and involving private partners. And partners must cooperate to create value and to compete to capture it (Hannah and Eisenhardt, 2016). The firm is considered as participant to the ecosystem dynamics, but no insights are given on individual characteristics of organizations.

Another point of view on ecosystem generation is provided by the process of platform design. As the ecosystem emerges, it does it on the base of a platform. The design of the platform has been identified as a collaborative process among partners, including activities such as the management of value creation, the organization of knowledge production and the management of interests of each partner (Le Masson et al., 2011). Essential features of industry platforms have been stated, such as fixed attributes, networks of users and utility functions for the attributes (Le Masson, P. et al., 2011).

The ecosystem-related literature provided critical templates to consider that a collection of players can deliver and share value in a more complex way than a linear value chain. Ecosystem became a recognized structure. Characteristics of ecosystem based on digital tech have been elucidated, but nothing is said of the creation dynamics. However, we clearly need more insights about the early times of emerging ecosystems, and about the interaction between the ecosystem generation dynamics and the role of the organizational structures of the heterogeneous actors of such generation. How partners get together and how such activities interact with partners' internal organization is still to be investigated.

As the systemic and disruption innovation management involves the action in the unknown with cognitive and social challenges from individual and organizational perspective, and as platform design and experimentation must be performed with ecosystem-width based scaling consideration, we sought the contribution of design and innovation sociology literature to complement our quest of theoretical insights.

2.4 Design, Conception and Tools

The elucidation of the theoretical context from the ecosystem literature and the innovation management perspectives, drove us to the consideration of complementary disciplines in order to comprehensively map the models and factors governing the process of partners' alignment toward co-creation in unknown conditions.

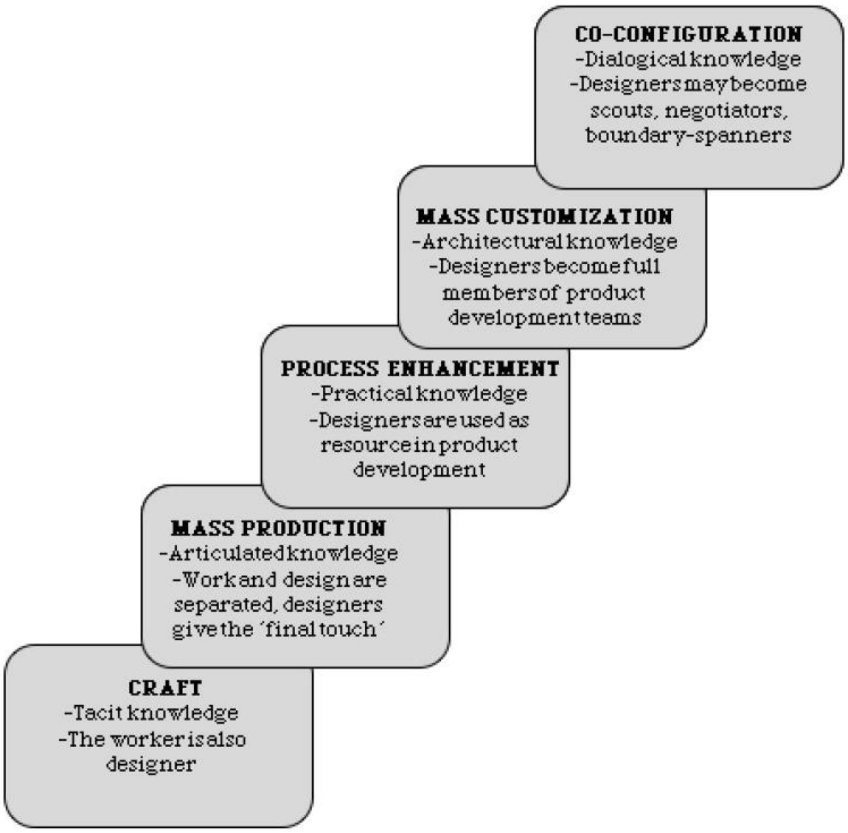
The elements we took from the above streams of literature left open space of investigation as far as emergency of ecosystem on a more soft-skilled area of knowledge, and more specifically on how interactions among heterogeneous actors are managed in order to internalize knowledge, create new knowledge and sense-making toward exploration and innovation deployment. As systemic and disruptive innovation involves the evolution of socio-cultural models, we then choose to include design and innovation sociology as complementary disciplines to our literature review.

Actor's alignment is a key issue in the context of an innovative design process, especially when they involve an ecosystem of players which have very different cultures/cognitive distance. If this alignment is difficult to obtain in a context of stabilized object's identity, offers and business models, it is more difficult when the nascent innovative ecosystems begin with a rough definition of the value proposition, and more widely the underlying business model of their temporarily (or not) common path. Departing from this, players progressively build the concept and the perimeter of the offer. In this work, we pay a close attention to this early design process, trying to catch how the various individuals, players, companies, individually, collectively and progressively make senses of what they are designing, and of what will come out the project.

As this design process has been considered as a critical dimension of innovation management

(Hatchuel et al., 2006; Utterback et al., 2006; Verganti, 2008), as important strategic business resource (Dell'Era et al., 2010), and social interactions are part of the design process (Dorst, 2006), which is an "*object of social enaction*" (Alexiou and Zamenopoulos, 2008), we should carefully observe and analyze projects from this angle, involving a wide scope of heterogeneous players, which are incumbents in different industries and or sectors, have different experiences of exploration, business models, etc. In this part of the literature review, we take a closer look at the literature which describes such design mechanisms and innovation appropriation from design and sociological perspectives, in order to better frame the cases analysis and our results.
If we take an historical perspective on the role of design within organization, we note that, as a result of the external pressure for competition, industrial processes evolution and the emergence of the co-configuration (Victor and Boynton, 1998), design activity and processes role within an organization historically progressed to the point of becoming as key enabler of boundaries' crossing. The historical evolution of the design role applied to industrial organizations is synthetized below:

Figure 23 Ideal types of design depending on industrial evolution



Source: (Victor and Boynton, 1998)

Co-configuration applies to situations in which objects are shared among multi-organizational fields (characterized by different activity systems) and productive collaboration across organizational

boundaries is still underperforming. In such situations, design as "*Self-reflecting renegotiation of collaborative relations and practices*"(Engeström, 2006) appeared to be the key toward collaboration performance. In recent studies, it has been stated that design focus evolved from material and immaterial objects to complex adaptive systems, platforms and product service ecologies design (Dubberly, 2017; Ito, 2017). The above mentioned negotiation capability of design with the focus on complex adaptive systems might well apply to systemic and disruptive innovation management challenge in the context of platformization blurring the edge of industries' confines.
As disruptive innovation as *technology epiphany* involves radical changes in technology and in meanings (Norman and Verganti, 2014), meaning making requires imaginary elaboration and coherence embedded into design practices (Gentes, 2017), and creative design might open new spaces of possible design toward potential paradigm shift (Gero, 1990), our target is to better understand the individual and collective dynamics of situations in which individuals and teams face new variables, when they can design with unfamiliar structure and unknown situations per appropriability and distance from dominant design.
Our complement of literature investigation is rooted in a cognitive approach to the activity of creation. We then applied two filters, individual and collective, while scouting academic state of the art in design and innovation sociology models and tools relevant to the process of alignment in co-creation. We are interested in investigating which are the peculiar dynamics of an individual while engaged in exploration activity as well as the dynamics of a team which must achieve a common goal at the end of the exploration and design phase.

A specific attention is devoted to exploration of the role of artefacts in the alignment process. We anchor identification of artefacts as relevant components of the cognitive process, as the design is material culture comprising the ideas which govern the nature of every sort of artefact produced, used and valued by man (Archer, 1979). If we analyze the etymology of the term, the artefact is something made (from latin *Factum*) by or using art (from latin *Arte*). By art, it is intended the specific aggregation of rules and cognitive and technical experiences, therefore including the rules and procedures related to the development of a human activity toward specific results. Therefore, by definition, artefacts embody human values. If we go a step beyond the individual and its relationships with an artefact, and we approach the collective action of creation and interaction with socio-technical artefacts, we find that they have the connotation of consensual objects as they embed the protection of the interests of a group of actors (Callon, 1986a; Strum et al., 2013). Furthermore, they are part of the co-evolution process of society and knowledge, in which they participate to the translation of roles for a durable network (Callon, 1986b). In such approach, they co-build the durability of the network through the knowledge evolution (Callon, 1986b), as they are the expression of a social constructed character (Bijker, 1997).

In the following sub-chapters, we set the stage of the cognitive perspective on knowledge generation as individual action and social dynamics results, in order to nurture our research on elements relevant to partners' unknown exploration and alignment. We elucidate the relevance the design and sociological perspective have in innovation management, and deeply analyze the role of artefacts in such process. We conclude with the analysis of the relationship between such elements and the field of our study, the mobility.

2.4.1 A cognitive approach

2.4.1.1 A constructivist view of human knowledge

Our work is rooted in the constructivist approach (Guba and Lincoln, 1989). This perspective induces initially an ontological bias on how we know reality: reality is in fact made up of multiple socially built realities, but on the other side, reality does not exist independently from the actors who live it and describe it (relativistic assumption of ontology).

In epistemological terms, the "truth" is defined by Guba and Lincoln as the construction "*best informed and most sophisticated on which there is consensus*". As a step forward, the paradigm of radical constructivism considers that it is impossible to know the degree of similarity between the representations which the observer built in connection with its experiment of reality and reality itself (Moigne, 1995).

This bias rests on Piaget's vision of cognition as adaptive function (Piaget, 1967) and knowledge as a "*collection of conceptual structures….viable within the knowing subject's range of experience*"(Von Glasersfeld, 1998). The perception of reality is therefore fundamentally linked to the subject as each one generates unique mental designs of interpretation related to its experience path; the interaction observer-observed produces knowledge according to a process of assimilation/accommodation which differs according to the observer.

It is filtered by mental designs which enable us to make direction of reality. Kant contributes to the debate on reality generation, as he stated that reality is put in form by the understanding and its categories. In Piaget's vision, reality models our structures of interpretation in a dynamic way. In short, individual perception shapes already the game of knowledge generation. Cognitive approach is particularly relevant in conceptual exploration, where interpretation of representation is related to the situated-ness (Gero, 1998), modifying how people see reality. While dealing with situations undefinable by a close list of objects, due to lack of previous design or social conventions, the design path was identified into expansion of concepts by adding qualifying properties (Hatchuel, 2001).

But if knowledge generation is fixed so much on the actor and his representations and interpretations, how can we make knowledge shareable, actionable within collective processes?

Open each other cognitive door might be a socially-built sense-making process. As in linguistics the inter-comprehension creates a space of understanding, by being "*The development of the capacity to co-build a meaning when different languages get in contact and pragmatically use it in a specific communicative situation*" (Capucho, 2004), knowledge building and mediation might to be localized in a collectively generated space of exchange. And this is the reason why we embrace socio-constructivism as fundamental step toward understanding of partners' knowledge sharing, sense-making of unknown situations and alignment path.

2.4.1.2 Socio-constructivism as a basis of inter-comprehension

Once set the basis of the approach to individual knowledge generation, we move forward on the exploration of the knowledge generation and sense-making from a collective perspective, and to answer the question on knowledge sharing, we bring into play the socio-constructivism approach. Literature provides elements on how individual learning is related to the social dynamics the individuals experience while interacting, as the situated learning paradigm advocates (Lave and Wenger, 1991), and meaning making has social and collaborative nature, as observed in science education (Hodson and Hodson, 1998).

On the one hand, the production of knowledge, even if it is done in a specific way to each subject, is not done overall, it is nevertheless influenced by collective mechanisms of isomorphism, like the membership of the same community, the language or the negotiation, which direct the creation of knowledge, mental designs and the language in a "cone of inter-subjectivity". In addition, this possibility of inter-subjectivity is reinforced within the framework of the organizations and institutions, which spend their time producing discourses on them, these cognitive collective representations being reinterpreted by the actors who in their turn mobilize them to make direction of their action (Weick, 2000). If we move from a firm-centric observation angle, to a multiform perspective, sense-making in partnership should be the brick on which to build a common purpose. It has been noted that common purpose could be designed by management of the intersecting concept and knowledge spaces of participants (Gillier et al., 2012).

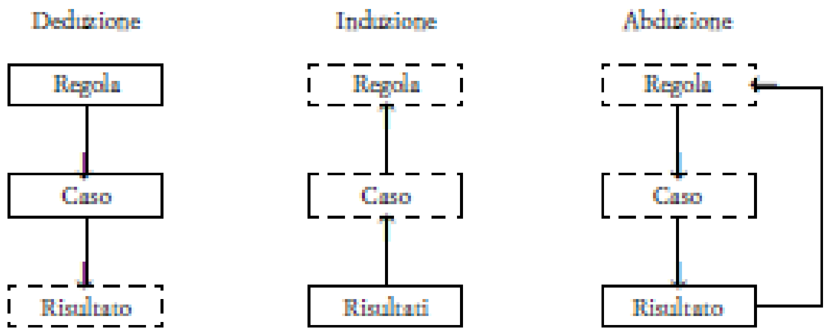
Consequently, we should consider that there is not a "truth" on the operation of the organizations, but only of the plausible and compatible discourses inter-subjectively. Any interpretation, schematization, proposal, put in typology, tool, etc which makes it possible to the actors to effectively coordinate themselves to achieve a goal constitute a scientific knowledge. There is no truth, but degrees of the concevability and actionnability.

Digging into the pragmatist theories of habit and reflective inquiry (Dewey, 1933; Peirce, 1867), collective activity is analyzed as a discursive process, combining stabilized and socially shared segments of signification ("habits") and situated inquiries to adapt or recreate habits. Discourses are relevant in the dynamics of a collective activity; discourses, as collective cognitive representations of organizations, they are an enabler tool for individuals in action; their re-interpretation operated by individuals is key to their sense-making process (Weick, 2000). Collective activity, through a discursive frame, adapts or reconstructs habits and it drives to a socially built significance (Lorino, 2013). The approach of the organization relevant to the understanding of individuals interacting toward collective action is therefore the one characterizing the organization as a node of interactions and as a political coalition; its actors' behaviors are guided at the same time by the expected result of the collective action, but also by clean interests and routines resulting from the past (Crozier and Friedberg, 1977; Cyert and March, 1963).

If we define that the alignment process has cognitive connotations, in an exploratory situation we decided to integrate the above elements with the logic process we, humans, utilized while creating. The interest of exploring design literature on the quest of key factors for sense-making and alignment emerges from the analysis of the logic process behind design activity. The inquiry including abduction logic, part of the design process, is key to sense-making process: abduction involves the creation of new artefacts and schemes aiming at understanding a situation and through such instruments people can restore the meaning of the collective activity (Peirce, 1867). Abduction involves emotions and rational thoughts and it allows changing the sense-making story of a situation, as obliges to look for another narrative explanation of the situation and the surprising event become understandable.

Abduction was also described as the design of a meaning rules system through with a sign will acquire its meaning, as per the process visualized below:

Figure 24 The Abductive process



Source (Eco, 1997)

In more recent studies, the abductive reasoning behind design process, the ‘Design Thinking’ paradigm, has been proposed as composed by two steps and part of a deliberate strategy following a defined structure aimed at problem solving (Dorst, 2011).

The logic process of inquiry in design is therefore the focal starting point of several design theories and methodologies aimed at exploring the unknown, some of which are particularly suited to Dorst definition of deliberation of a strategy and definition of a structure. Based on design definition provided by Hatchuel (Hatchuel, 2001), the design process was theorized as based on the interplay of two spaces, concept and knowledge, and it value has been extended from problem solving to knowledge generator. C-K theory was introduced as theoretical model for product/services identity renewal (Le Masson et al., 2010). While applying convergent and divergent reasoning, C-K theory considers the cognitive and social dimensions of the design process and addresses the collective dimension of the design goal in an innovation process, which should involve the value creation for all the stakeholders involved.

Cognitive style, as ways of organizing and processing information is relevant in the determination of individual, impacting organizational systems and processes such the creation and management of knowledge (Sadler-Smith and Badger, 1998).

In a collective conception situation, problem definition and solution elaboration is performed during interaction; designers must perform several transformations of the representations associated with the artefact, in order to build a progressively more detailed representation of the goal to be achieved (Gero, 1990; Hoc, 1987). Interactions rules are not pre-defined though. The coordination of agents involved in the collective conception situation is achieved through a learning process of new categories’ construction and knowledge re-construction and reorganization (Alexiou, 2010). Cognitive and social dimensions are then linked together in a distributed process.

The process of knowledge generation, structuring and applicability has been identified as generator of strategic innovative capabilities, when firms recognize, assimilate and apply such knowledge (Cohen and Levinthal, 1990) and such capabilities are influenced by the position of the firm within a network (Tsai, 2001). The similarity between absorptive and creativity capacity (Cohen and Levinthal, 1990) drive the questioning on the positive influence creative methods might have in absorptive capacity. As we are interested in ecosystems, networks, and more generally in complex social system, the creativity fostered at individual and group level must be supported by organizational characteristics for a firm to perform in organizational creativity (Woodman et al., 1993).

Once the pertinence of social constructed knowledge generation and meaning making stated, having groups' interactions and contextual stimuluses as relevant elements to sense-making and creativity influencers, we explore the link between design and sociological perspectives and the management of systemic and disruptive innovation.

2.4.2 The diffusion of innovation, a design and sociological view

2.4.2.1 The design and sociological implications of managing innovation

When exploring highly systemic and disruptive innovation, we are placing the research focus on the realm of unknown uses and undefined technological standards, implying the modification of the context in which the innovation is proposed. As innovation is a social construction actioned by the actors (Weick, 2000), the challenge organizations face seems to be characterized by the lack of one dominant technical frames for interaction guiding, therefore the problem structuring is relatively open and several innovative solutions can be found for relevant social group enrollment (Bijker, 1997).

Significant inputs were given by several authors, highlighting the need of changes in the environment (technological frame) in which products are used (Callon, 1991; Geels, 2004; Latour, 1987) and the need of cognitive and sociopolitical legitimacies to move forward the lack of dominant design (Aldrich and Fiol, 1994).

During the emergency phase of a new industry, the lack of convergence on dominant design delays the definition of standards to be followed, and impact the shared understanding of the purpose and performance of participating to a new industry, i.e. the cognitive legitimacy of it (Aldrich and Fiol, 1994). In the case of starting a new line of activity, such legitimacy appears to be reached through conform, select or manipulate organization's environment (Suchman, 1995), for all of which collective actions such as knowledge dissemination through inclusive symbolic language and behaviors, or involvement of third party actors are required to gain familiarity and trustworthiness (Aldrich and Fiol, 1994).

Therefore the role of users and actors allowing the innovation to be available to the users are all relevant from a sociological point of view. This implies a redefinition of the parameters for evaluating decision making on successful innovation projects, as decision making should be able to generate interest aggregation among allies (Akrich et al., 1988). In the case of emerging ecosystem in digital platform, we are confronted to a network situation similar to the "*modele de l'interessement*"(Akrich et al., 1988), where the active participation of several actors all interested in pushing for innovation deployment is needed, as intrinsic properties of innovation cannot ignite by themselves the diffusion dynamics. Two other key characteristics of the sociological perspective to innovation appeared suitable for the research question we took as challenge: the collaborative approach and the time frame.

As far as the collaborative approach, the success of innovation is linked to the adaptation of it to the specific need of the location where innovation is deployed, and such adaptation is achieved by collaborative work among actors. This element challenges the deployment of digital platform based ecosystems, as collaboration appeared needed to achieve both feasibility and acceptability that, for the "*Modele de l'interessement*", are social and technical related at the same time.

As far as the time frame is concerned, a key point is that actors' motivation is not only on a static view of innovation relevance, at the moment of project kick-off, but on the long-term vision to keep the interests aligned.

The impact that scientific laboratories, and therefore research, have on Industry conditions of the future has been stated, with the identification of the relevance of the context, as juxtaposition among actor-world and actor-network (Callon, 1986b). The analysis done by Prof Callon of the case of EV, revealed the key contribution of the first mover and the relationships among actors to the success of the world created around the innovation. We are then in the space of the platform and of the value creation by its actors.

Furthermore, as the value of multisided platform is mainly driven by externalities, and the identification and management of such externalities seem difficult, we found that framing such systemic innovation project through sociology of innovation could effectively complement our quest of factors for effective management of emerging ecosystems based on digital platforms. Externalities are generated when some agents are involved in a commercial transaction or negotiation of a contract, and it requires the framing of the action, in absence of which no agreement could be reached (Callon, 1998). Framing has physical and symbolic devices. So if effective framing is needed, how is it built? The productivity of the contract appears to be given by the framing coupled with tangible and intangible elements, such as concepts, materials, substances,

experimental devices and researchers involved, all contributing to outline the frame. Allocation of resources through negotiation among agents is therefore possible if preferences are defined, hierarchized and negotiated in such framed context (Callon, 1998).
Among the collective actions above described, such as preferences negotiation, action framing, agreement reaching, we also have to consider that successful innovation deployment includes the collective effort of updating notions key to innovation adoption, such as actor or technologies, that have the peculiarity of being fluid for their identities and performances (De Laet and Mol, 2000).
In systemic and disruptive innovation exploration projects, we are clearly in a "*hybrid forum*" (Callon 1998), as several elements are controversial (such as identification of intermediaries and overflows, the distribution of source and target agents, the way effects are measured), actors negotiate identities and interests, we recognize absence of stabilized knowledge base and the involvement of a wide variety of actors and knowledge production and dissemination and decision making process are simultaneous. Furthermore often there are no commercial transaction at the beginning and we do not have a contract neither (if by contract we define a formal written agreement with duties). Nevertheless, the value proposition is built and performed collectively, with agreements that are ill or not defined at all at the beginning of such projects. And the value assessment of the networked actors is strictly related to the generation of externalities.

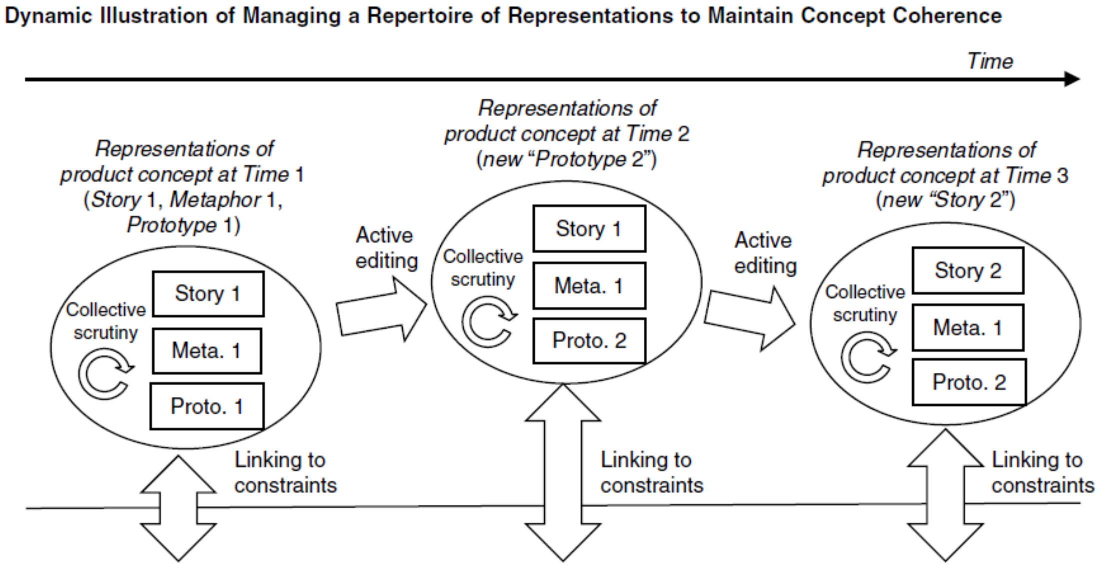
The definition of the geography of externalities needs the recognition of a corpus of knowledge, and in case of hybrid forum, the body of knowledge is formed by specialists and non-specialists. The Anthropology of science and technology (AST) has acquired some useful tools for describing the dynamics of these confused situations or 'hybrid forums' (Callon et al., 1986; Latour, 1987). When uncertainty characterizes the context and uses are not defined yet, social practices seem to play a relevant role toward the definition of structures. In case of lack of use definition as in highly disruptive innovation, the emergent and situated use of a technology is shaped by the enactment of users (Orlikowski, 2008), and innovation appears to be systematically driven by inferential laps in which synthesis as step of the creative process allow information and knowledge production toward abductive sense-making (Kolko, 2010).
Uncertainty is also generated by other factors: the gradual evolution of the material to be engaged in the innovation process is toward more abstract and animate material, and the new questioning about design processes is on relevance, translatability and efficacy (Steward, 2011).
The critical role of knowledge in innovation deployment and in competitive advantage creation has been stated (Kogut and Zander, 1992; Nonaka and Takeuchi, 1995), as well as the relevance of understanding and managing Knowledge boundaries across functions for a successful innovation deployment (Carlile, 2002).

Individual cognitive style intervenes also in between the aptitude and ability to affect performance of organizational settings such learning capacity, strictly linked to the organization's innovation performance. Individuals influence a share mental model relevant to sense-making process of a team (Sadler-Smith and Badger, 1998) and when mobilization and mastering of new resources is achieved, a change in the way people believe can be achieved (Latour, 1986).

Nevertheless knowledge development toward concept definition must aim at structuring the coherence of the concept itself.

Once the goal in product innovation is stated as the unity of desired product attributes, coordinating practices through collective action are the means toward shared interpretations and therefore concept coherence as shown in the model here below, which will result in a solid value proposition to users. If interpretations could not be compatible, then the process should iterate toward an additional step of editing of the repertoire of representation to move forward.

Figure 25 Dynamic Model of management of repertoire of representation



Source: (Seidel and O'Mahony, 2014)

Counterintuitively, the model proposes design constraints as fosterer of team focus through representations' selection and enabler of coherent design decision making among persons from different disciplines. But at the same time, the early introduction of design constraints defines a bounded space for novelty exploration. Furthermore, such phase of novelty exploration might be jeopardized by the practice of re-using knowledge, resulting in a limitation of individual and collective capacity to represent differences and dependencies (Carlile, 2004).

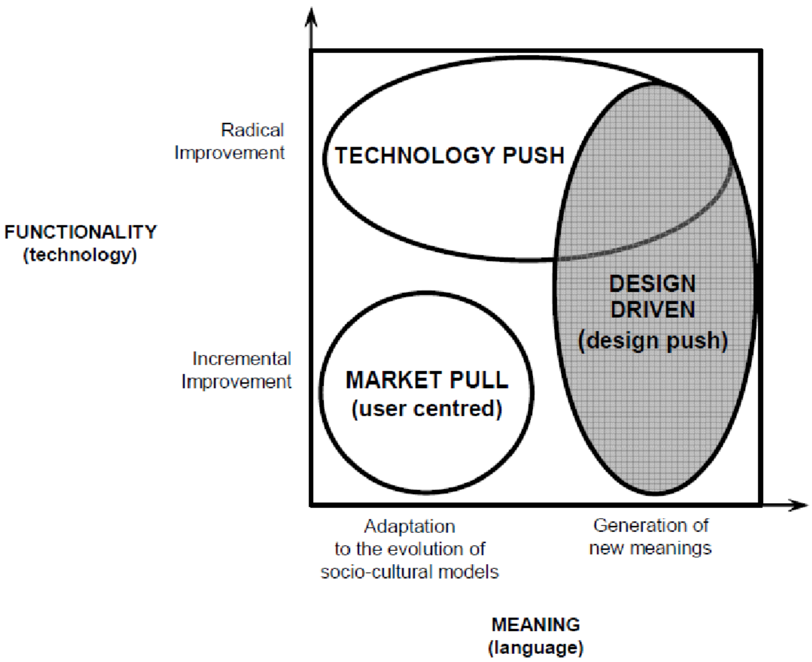
And such process has been analyzed for teams composed by employees of a same company, which have a limited degree of un-coherence among final goal per each participant. Variables outside the team facing the creative challenge were relatively stable. The reconciliation of individual representations might be more complex when individuals belong to different organizations or different disciplines and have different understanding of the objects and the representations they convey (Nicolini et al., 2012) .

In such cases, opportunities for expansive learning might arise from temporary misalignment among design process participants (Engeström, 1987) or from the complex nature of the objects (Nicolini et al., 2012).

As an additional input on innovation performance of a team, cognitive proximity of actors was linked to a negative impact on the innovation process, as it has been proved to contribute to the lock-in phenomenon, decreasing interactive learning and innovation potential of a team (Boschma, 2005). A high degree of cognitive distance of actors was stated as positively related to the innovation performance through exploratory learning of collaborative settings such the interfirm alliances (Nooteboom et al., 2007)

A firm-related view on innovation strategies based on different degrees of product functionality and meaning provided salient input on the role of interpreters as link to external environment and the proposal of design driven innovation as alternative to user centered innovation (Verganti, 2008). The characterization of the typology of innovation strategies based on these two factors is presented in the figure here below:

Figure 26 Innovation Strategies



Source: (Verganti, 2008)

The proposed design-driven innovation process is aimed at better performance on accessing, sharing and internalizing knowledge on product languages and influence shifts in socio-cultural models; it starts from observation of design processes in a given organization, in which the object to be designed becomes transitional as it will be the result of a transformation of the meaning of the object itself and it will be emotionally linked to users. The key message to incumbents in such design-driven innovation approach is that their design activity must be performed through interaction with interpreters, intending "*to share their own visions, exchange information on trends, test the robustness of their assumptions… knowledge about socio-cultural models is diffused within their external environment*"(Verganti, 2008). The knowledge related to socio-cultural models, product languages and meanings, relevant to generate new meaning, it must be merged blended with the technological knowledge incumbents can share with external actors and at the base of a new regime. Radical innovations will then emerge from the knowledge generated from interpreters/incumbents interaction, able to influence future socio-cultural models.

The interaction might take the shape of employment contract, or consulting, although knowledge recombination process is not described, as mentioned part of the study of other scholars (Zurlo et al., 2002). The interaction results in increasing everyone's ability to understand and influence, but the development of radical innovation of meanings is always a one-actor performance. The networked laboratory generates a global design discourse as a collective research process on socio-cultural models with ingredients such as (i) several actors in global and local settings; (ii) continuous dialogue; (iii) explicit and tacit interactions; (iiii) given context of use.

Interactions, networks, platformization of industries: the number and typology of relationships and interfaces to be considered in systemic and disruptive innovation, they shall all be mapped in an holistic process, the platform design. We then question the literature on the design processes and the objects to be considered addressing platforms design.

What has to be designed in a platform? Literature extensively treated the topic in the case of industrial and product platforms, and provides insights. At first, literature concentrated in the design of platform for economies of scale maintaining, cost reduction through maximization of commonalities among products originated from the same platform and increased computational efficiency; models such as the Product Platform Concept Exploration Method (PPCEM)(Simpson et al., 2001) have been developed as a 5-step process and based on the fundamental principle of meta-models validation.

From a structural components point of view, the design process should generate the so called core of the platform, i.e. a set of attributes (Gawer and Cusumano, 2002; Gawer and Henderson, 2007) and their degree of modularity (Baldwin and Clark, 2006, 2000). Then, from the core, a network of actors can be designed, indicating all the users involved with the platform, as well as the network's properties such as scaling (Eisenmann et al., 2006), side-effects (Eisenmann et al., 2006; Parker and

Van Alstyne, 2005), mobility and value creation (Jacobides, 2006). The analysis of a systematic, linear approach to platform design toward scalability has been provided in the context of product platform- product commonalities maximization for manufacturers (Simpson et al., 2001). Following such approach, scalability is based on long lasting fixed architectures. In the case of industry platform, the reference of the platform design process has been provided by Gawer and Cusumano, and it is strongly linked to the ability of the platform leader to transform the platform potential of the core through technology and business actions (Gawer and Cusumano, 2008). Stability of architecture (Gawer and Henderson, 2007) and level of modularity (Baldwin and Clark, 2006, 2000) are important features of the scalability of a platform. The digital disruption intervenes in the dynamics of such factors, allowing industries platform merging, and the creation of new design spaces for new capabilities and architectures.

Nowadays the design of complex systems in case of industries such as aeronautics and defense face relevant financial underperformance in terms of innovation deployment process, which could be addressed by adopting a value-driven design process (Collopy and Hollingsworth, 2011).

An complementary vision of the platform design process takes the distance from the linear and leaser-drive perspectives, to address the design process of a platform as the phase during which alternatives, partners and interests emerge, involving a cognitive framing process applied to conception alternatives and knowledge management as a capability creation process (Le Masson et al., 2011). In order to perform such activities, platform partners must engage in collaborative design, and in the case of systemic and disruptive innovation, they have to do it while building new capabilities and exploring new architectures. Indication on how to perform such tasks were identified in wide exploration process of platform alternatives and deep revision of the existing platforms, enabled by a design process alternating convergence and divergence of alternatives and partners' interests (Le Masson et al., 2011).

The identification of technological conditions as a key step toward exploration cost reduction and been set among the strategies for emerging platforms in case of market and technology uncertainty (Kokshagina et al., 2013).

Having set the stage of platform design process perspective including the features to be designed, we investigate the topic of users' role in the exploration of systemic and disruptive innovation, as a key step toward successful innovation deployment in a later stage of the process. User-centeredness of design activity has been claimed as the new paradigm for new product or services successful adoption. Not limited to a deployment perspective, users can also play a role in a firm's strategic assets building, as knowledge generation; users influence knowledge creation with the input of their perspective in investigating the real nature of the problem to be solved (Stickdorn and Schneider, 2010).

Literature in user's involvement is strongly rooted in Ideo's design process, known as Design Thinking, as the achievement of innovation requires technology, business and human needs considerations (Brown, 2008). In terms of relevance of approach to platforms and ecosystems design, the deep analysis and understanding of human needs, behaviors and preferences allows a large exploration of alternatives, which widen considerably the innovation ecosystem, to a space in which companies co-create with customers and consumers. Taking the example of health care system, Design Thinking is considering hospitals as the starting point to reach a larger ecosystem of actors impacted by the services, instead of the end point of a linear cycle of service selling (ex of rural area in developing countries). This approach is claimed to help in finding systemic solutions.

Another impact of the Design Thinking process in the exploration for innovative solution is that by rapidly testing solutions via prototyping and iterating, it might shorten the time of transition between prototyping and mass manufacturing. If we go beyond the scope of innovation firm-supplier-user network and we embrace the realm of system-to-system innovation, Design Thinking is becoming a diffused training method in order to foster knowledge sharing for successful coopetion, as in the case of medical administration (McCarthy et al., 2018).

In the quest of salient elements toward an effective process of individual representation toward collective sense-making, we investigated the role of artefacts as management tools in such creative process.

2.4.2.2 Artefacts, the tool for cognitive performance in innovation context

As stated by Berry (Berry, 1983), the key role of management tools has to be searched in structuring the real through complexity reduction, social relationships regulation, a certain degree of decision automatism, coherence and vigilance division. When we question the position of meanings in the relationship between production and application of a technology in order to situate the impact for innovation exploration and deployment, we observe that literature places the use of artefacts as the area in which meanings influence the socio-technical system of a given industry, as shown in the diagram here below:

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Figure 27 Socio-technical systems constituents

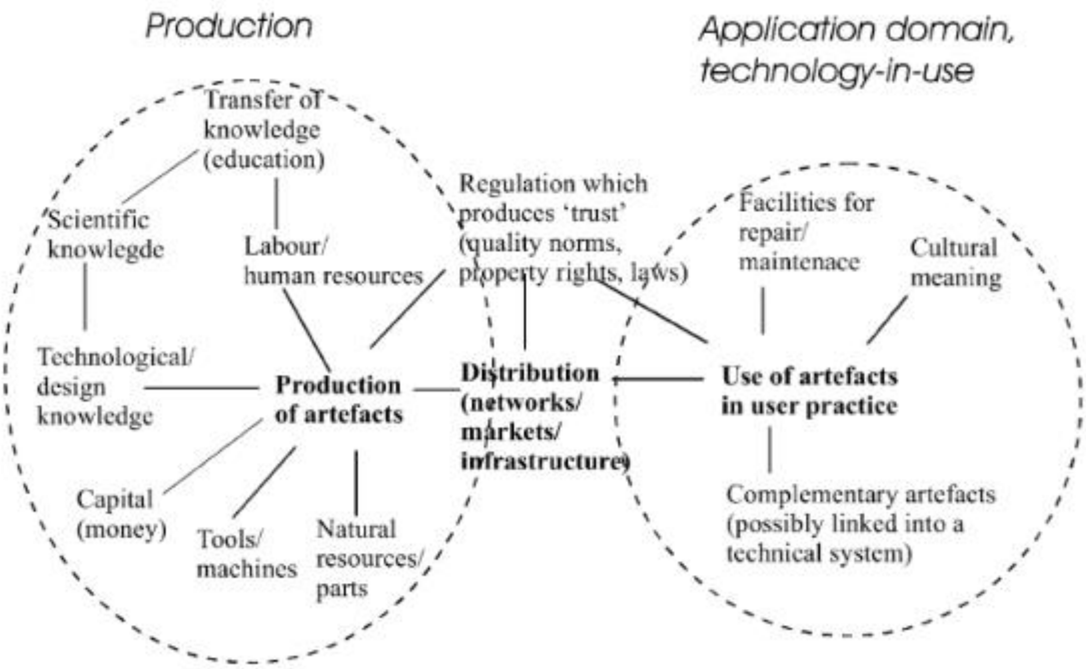


Fig. 1. The basic elements and resources of socio-technical systems.

Source: (Geels, 2004)

Artefacts as design space

The space of artefacts design was identified as the creative design space (Gero, 1990), in which new variables needed to be included as technology is not proven and or user needs poorly defined. In creative design, artefacts such as prototypes have proven to act as de-fixation tools for improving originality in creative design process (Youmans, 2011), and they are adapted to generate new prototypes following the introduction of new variables (Gero, 1990), which will make them a dynamic tool for exploration. Innovation exploration needs a disorientation of technology. Furthermore, they have a role as part of the learning process. In an efficient innovation process, the learning goal from a prototype should be defined upfront the creation of a prototype and should be analyzed by people with different learning styles (Beckman and Barry, 2007). In order to do this, designers need confrontation with spaces. And the use of maquette is key for designer as negotiation or mediation object toward the discovery of the potential of technology (Gentès, 2008). The mediation dynamics of the artefact was described as the interplay between object and subject, the connection maker between stimulus and response (Vygotsky, 1978).

The relevance of visual representation in the creative process has been identified in their *meta-indexical role*, as they serve as holding ground where codified and un-codified knowledge can meet, bringing together various level of tacit knowledge (Henderson, 1999). Besides, artefacts can foster the concept coherence achievement along the process. The effectiveness of the artefact to represent knowledge for a coherence of concept has been linked to their ability to satisfy the information requirements of the social worlds involved in the process (Star and Griesemer, 1989), to collective scrutiny of representations, to the ability of connecting representations to design constraints and to representation active editing (Seidel and O'Mahony, 2014).

Artefacts as collective sense-making enabler in the unknown

When approached from a management tool point of view, conception can be defined as a process of distributed decision-making, involving the use of communication tools such graphic objects, as tool to manage interdependances among conceptors. (Falzon and Darses, 1996). Existing literature in innovation management provides elements to practitioners to effectively gain and integrate information and knowledge, by the use of boundary objects to cross boundaries between communities of actors (Kimble et al., 2010). Innovation dynamics can then be seen through the prism of the peculiar interaction between the knowledge broker and the object, resulting in different strategic options (control or balance of information availability among actors) for the broker, as shown in the table here below.

Table 4 The political interplay between boundary object and broker

	Collectively oriented strategy	Individually oriented strategy
The role of the boundary object	The boundary object functions at different levels: it contains both technical information and offers ways to work collectively.	The boundary object is an intermediary object, offering mainly technical information related to the innovation.
The interplay between broker and boundary object	The boundary object is mobilized by the broker to aid the exchange of information and to facilitate coordination between the actors in the collective.	The boundary object is mobilized by the broker to limit the amount of information available and to define the direction of the joint enterprise.

Source: (Kimble et al., 2010)

While interpretative differences have been identified as generative of communication and collaboration barriers in new product development (Dougherty, 1992), the collective validation of transformative process toward creation of new knowledge was proposed as effective process to lower barriers as knowledge is embedded in practice (Carlile, 2002).

Boundary objects such repositories, standardized forms and methods, objects or models and maps of boundaries are helpful for establishing a shared language intersecting cultural and social world, clarifying concrete concerns and means, representing knowledge and jointly transforming it (Carlile, 2002).

The suggested step of the collective creative process is to activate the functions of representations' transfer (the collective cognition) in order to integrate the different representations during problem representation and solution finding.

In this case, the artefact might not be the representation of the solution, but a tool to canalize the collective sense-making of the solution finding process.

The link between artefacts and sense-making process has been elucidated by different authors. While engaged in collectives, individuals are repeatedly trying to make sense of their own actions, which will require the renewal of their interpretation frame. They achieve it by handling artefacts of management and interacting (Schon, 1983; Weick, 2000). The role of artefacts as boundary objects in order to activate the distributed cognitive process to allow concept interpretation crossing among participants was stated (Henderson, 1991).

If assuming the same roles at a given time, material objects also motivate collaboration among individuals from heterogeneous disciplines, allowing them to work across different types of boundaries and providing part of the structure of the activity to be performed (Nicolini et al., 2012).

A classification of epistemic objects involved in cross-disciplinary collaboration generation and sustain is provided (Nicolini et al., 2012), in order to consider boundary objects as part of the objects involved in the collaboration generation and fostering.

As the ability to integrate of new knowledge and technology is key toward competitive performance (Iansiti, 1997), prototype tools as knowledge representation schemas (Gero, 1990) might be used in order to achieve common understanding of concepts and rapid learning when problems arise during the R&D and product development phases (Barkan and Iansiti, 1993)

In the definition of artefacts used in this work, we include management tools, as process, instrument panel, matrices, systems of reporting are all part of the discourse among actors and they play a central role in the explanation of the behaviors of the actors. They represent "*a formalization of the organized activity, what it is or what it will be (together of reasoning and knowledge to inform the acts of the trilogy: to envisage, decide, control)*" (Moisdon, 1997).

Management tools, part of the artefacts a team can use, are informational tools embedding psychological, semiotics and sociological concepts (Lorino, 2002), and they can contribute to collective sense making as they can enhance coherence, provide common language and contribute to leave spaces for dominant interpretive scheme modification (Lorino, 2007). Furthermore, as they are a junction node among structured systems of norms and representations and they might impose norms as an "*invisible technology*" (Berry, 1983), the design and use of such tools might exacerbate or solve the incoherence among such systems.

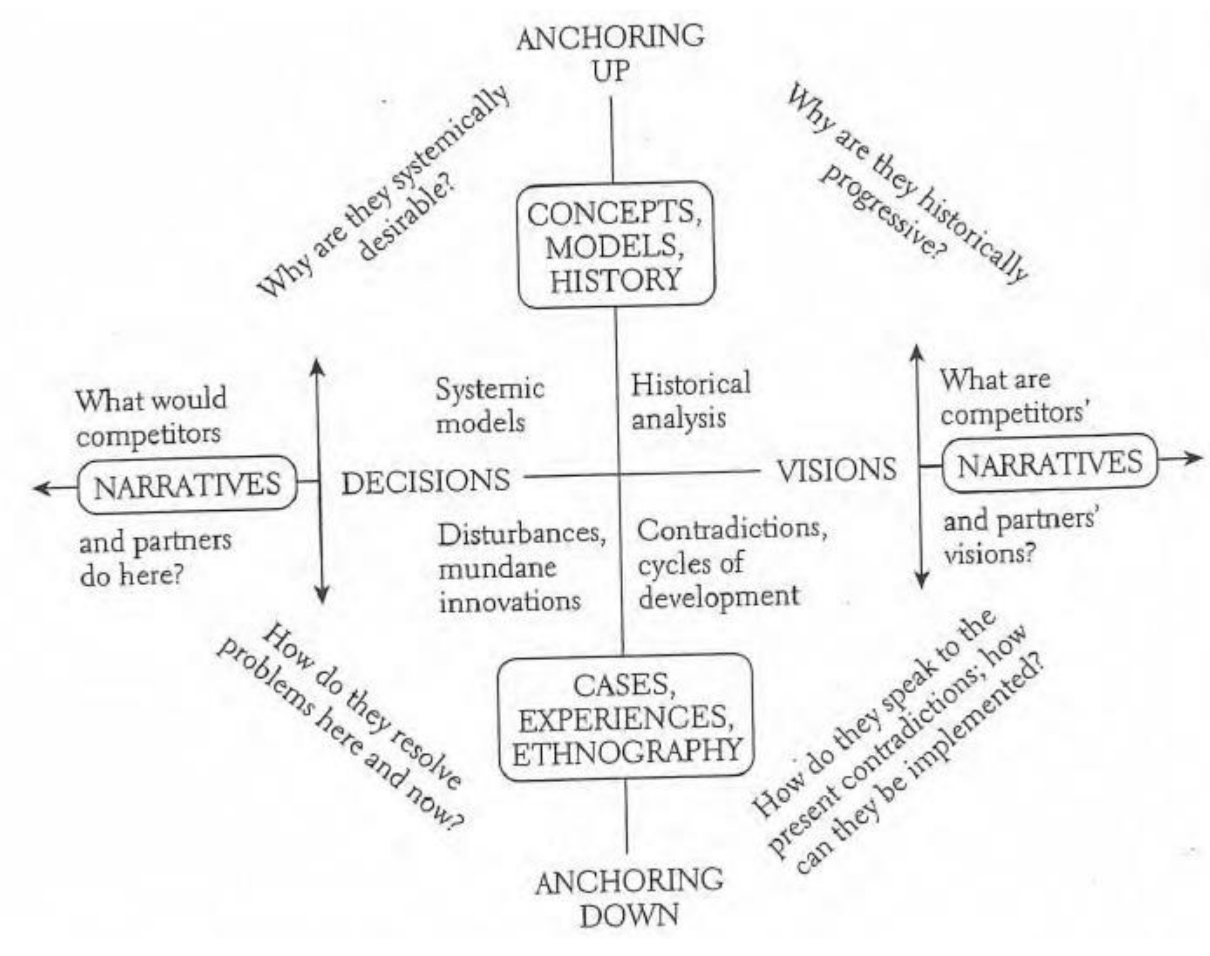
Artefacts such as Management tools have an impact in technology and disciplinary innovation deployment as they are social relationships articulation enablers (Berry, 1983), as they can contribute to strength relationship progressive crystallization.

Interaction with visual and physical elements is needed for knowledge creation during the design process. The sense-making is achievable through the visual components of interactions with objects or people. The sensorial information affects the sense-making, but it comes from pictorial, visual, verbal, narrative, spatial, kinesthetic and haptic. The sensory experience allows the reduction of ambiguity, the greater the larger number of senses involved, because the different forms of sense information have complementary properties. The ambiguity is the one generated by the identity of nationality (the domain of marketing) and the identity of creativity and individuality (the domain of design) (Rylander, 2009).

Sense-making in the unknown is important as it should drive decision-making process for innovation exploration and successful deployment. But which are the dynamics of collective decision making enabled by artefacts?

In the collective production of visions and decisions, it appears that different types of languages, epistemic actions and representational tools are demanded for fruitful interplay among team members (Engeström, 2004). Depending on the typology of questions, visions and decisions are "anchored" toward different dimensions, as shown in the figure below.

Figure 28 The dimensions of visions and decisions anchoring and related representational tools



Source: (Engeström, 2004)

Anchoring up, down and sideways in meetings in which participants need to produce vision and decision making will allow the interplay among different fields, and will improve transitions and relationship among the subfields approached during the investigation performed by the team. This should result in a re-configurative production of visions and articulate production of decisions, although further elements on transitions among the dimensions, on the relationship among tools to be used in the different dimensions and on how tools interact for the collective sense-making would help the process to become clearly actionable.

<u>Artefacts as interaction enabler with users</u>

An alternative use of prototype can be linked to the user inspiration in case of user involvement for ideas providing (Le Masson et al., 2003). Rough prototype of an existing service might be provided to users in order to ignite a sense of how the service could work and allow the users to become inspired.

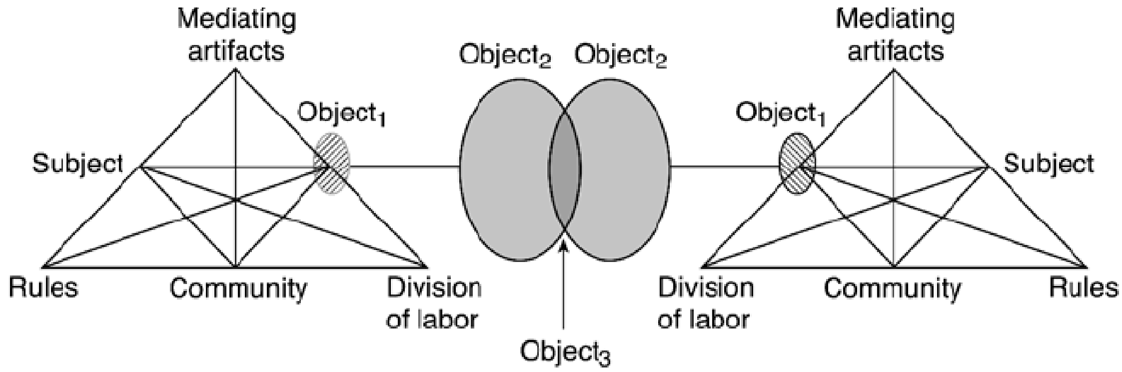
Prototype is a conceptual continuation of the creative phase, a tool to test hypothesis, to get effective feedback from users, and it is useful for language sharing among agents as well.

In order to motivate and retain user adoption of a service or product, artefacts enable the interaction between new object and people, particularly relevant in a context of rising relevance of gamification (Deterding et al., 2011b, 2011a), rule-based service systems, as artefacts can deliver instrumental outcomes and desirable experiences (Deterding et al., 2013).

Analyzing cycle knowledge creation for innovative learning in work teams, literature provides the paradigm of expansive learning as construction and resolution of successively evolving tensions or contradictions in a complex system including objects, mediating artefacts, and perspective of the participants (Engestrom, 1999). For him Engestrom, design can become expansive when we have more than one activity system involved in the creative activity.

If we characterize users and complementors of a platform on which the ecosystem is based as different activity systems, we can apply the following frame for the design activity, which should result in create output that are complex configurations of organizational arrangements, services and technologies.

Figure 29 Expansive design based on Activity systems interacting model



Source: (Engeström, 2001)

And the starting point seems to be recognition of different understanding of a same object, without initial shared object or problem, positioning the innovation solution finding as the last act of the "*painstaking period of object construction*"(Engestrom, 1999). Historical explanation, systematic comparisons, representational artefacts use and explanatory guidelines appear to guide such analytical process of collaborative achievement. Such elements appear complementary to the collaborative ignition factors suggested by Nonaka and Takeuchi, such as socialization and tacit knowledge sharing (Nonaka and Takeuchi, 1995).

From the above, artefacts design in the form of schemas, processes, prototypes and visualizations appeared very relevant to the partners' alignment process in systemic and disruptive innovation management, as artefacts act as intermediary (Jeantet, 1998) and generate embodied interaction among participants (Dourish, 2004) and consequently to progressively build sense-making of the target to be jointly achieved.

3.4.2.3 Application to mobility

Mobility emerges as a new paradigm involving highly specialized, interfacing and interdependent systems to deliver journeys characterized by combinations of presence and absence of people (Sheller and Urry, 2006). Innovation in mobility must consider such new prevalent modes of mobilized social presence/absence.

Such systems rely on an emerging technological frame, as a result of the merging and evolution of existing technological frames characterizing the relevant sociotechnical regime (Bijker, 1997).

Disruptive technologies impact on sociotechnical regimes influenced the way urban settings are defined. Such impacts produced a progressive splintering of metropolitan areas, as city in itself becomes a sociotechnical process, in which infrastructural bypasses become key to understand reconfiguration of users and spaces (Graham and Marvin, 2002). Digital telecommunication infrastructure fragments urban space, challenge existing infrastructure, and generating clusters of globally connected high-service enclaves, with the social risk linked to the creation of network ghettos and a fragmented experience of the city.

One of the major challenges for urban research is that "*Technologies and infrastructure networks must therefore be considered as socio-technical assemblies or 'machinic complexes*" (Graham and Marvin, 2002), and connected vehicle enabled mobility is among such networks. The fact that we recognize the need of such complex network of infrastructure highlights another dimension of our field of interest: the deployment of the connected-autonomous vehicle is a design problem.

It is such a problem because it lays at the intersection of different sectors, involving existing systems, but requiring the creation of new ones. Such situation has already been analyzed for the aerospace, identifying such transportation as system-of-systems design issue (DeLaurentis, 2005). The peculiarity of such system-of-systems problems is that its solution requires the integration and synthesis of large systems toward the satisfaction of a global need, and it involves different problems than those faced by the design of a single, but complex, system usually addressed by innovation teams.

Nevertheless, the systemic characterization of mobility systems opens to new innovation domains, including "*softmobility*", places, energies and services, where the practice of use determines the value generated (Amar, 2016).

Therefore the integration of large systems in the case of the connected autonomous vehicles might be better understood if we consider the approach to Critical mobility thinking (Jensen, 2009). If we consider autonomous connected vehicles as linking node part of the armatures of cities, in which people have an active role, then the practices of mobility are generative of meanings, culture, identities through aesthetic experiences, emotion attachment, the creation of spatial reference frame of a city.

Such vision impacts also the roles of actors and the detention of power in the mobility industry, as people constitute the city by practicing mobility. This changes also the understanding of power, which is nowadays created by "*the attachment of data to particles (that being goods, humans or signs), in a global networked flow system*"(Jensen, 2009). Furthermore, in case of highly disruptive innovation as the autonomous driving, the application of the designed innovation operates at individual level; the adoption of the tech depends on individual perception of desire, estimation of machine competence and its actual capability (Greenfield, 2017). Such individual dynamics create a chasm between beliefs and realization in which possibilities are designed.

It seems that in order to be sustainable and generative of positive value for society, mobility infrastructure should deliver an aesthetic experience and creating a spatial reference frame which makes sense in the context of relational geographies (Jensen, 2009).
Contemporary mobility practices challenge the established understanding of meanings. We questions if and how innovation projects on future mobility platforms can be "*mobile sense-making*"(Jensen, 2009) projects.
Such challenges include also a shift in the focus of the target of the exploration and innovation deployment process, which evolved from the customer to the user. Such focus evolution is relevant not only for the design of a value proposition, but also for the process of knowledge creation. Centrality to the user approach is clearly perceived by incumbents, as reported in the introduction of this research work, but the role of user in the knowledge creation is to be explored in the user-centered design literature.
Then if we search into a game design approach to urban mobility experience, studies in game design highlighted that the urban mobility experience is described by four anthropological features, "*the concrete city (physical organization), the imaginary city (narratives), the functional city (services) and the city events*" (Gentes et al., 2010). It appears that anthropological observation in the context of use are needed to design a pervasive experience, but quid if the context of use does not exist yet, as in the case of connected AV?
Then we need to build scenario, as an instrument for innovation through reality expansion (Hatchuel, 2006).
From videogames design process, we can derive relevant considerations on the role of scenario as creative mediators (Gentès, 2008). Scenarios are intended as a storytelling of interaction between personages and technical objects. While imagining a situation, the designer has the possibility of putting hard and soft elements under discussions; scenario allows unknown functionalities to emerge from the integration of technology to the context, the environment, as functions of object in action shapes its shape. There is a sense-relationship between the significant object and the space on which it is used as object gives credibility to a social environment. Then using videos in projects can enhance such relationship (Gentès, 2008). And scenarios are different depending on the urban settings (Gentes et al., 2010).
We present below the elements from design and social innovation literature on the basis of the characterization of individual and collective, and for each sociological dimension, if related to a situation of stable parameters, or unstable parameter and projection into the unknown.

2.5 Gap emerging from the literature review

From the literature review it emerges that the management of disruptive innovation is a subject on which academic research has been increasingly focused and on which it provides guidance through insights and management models.

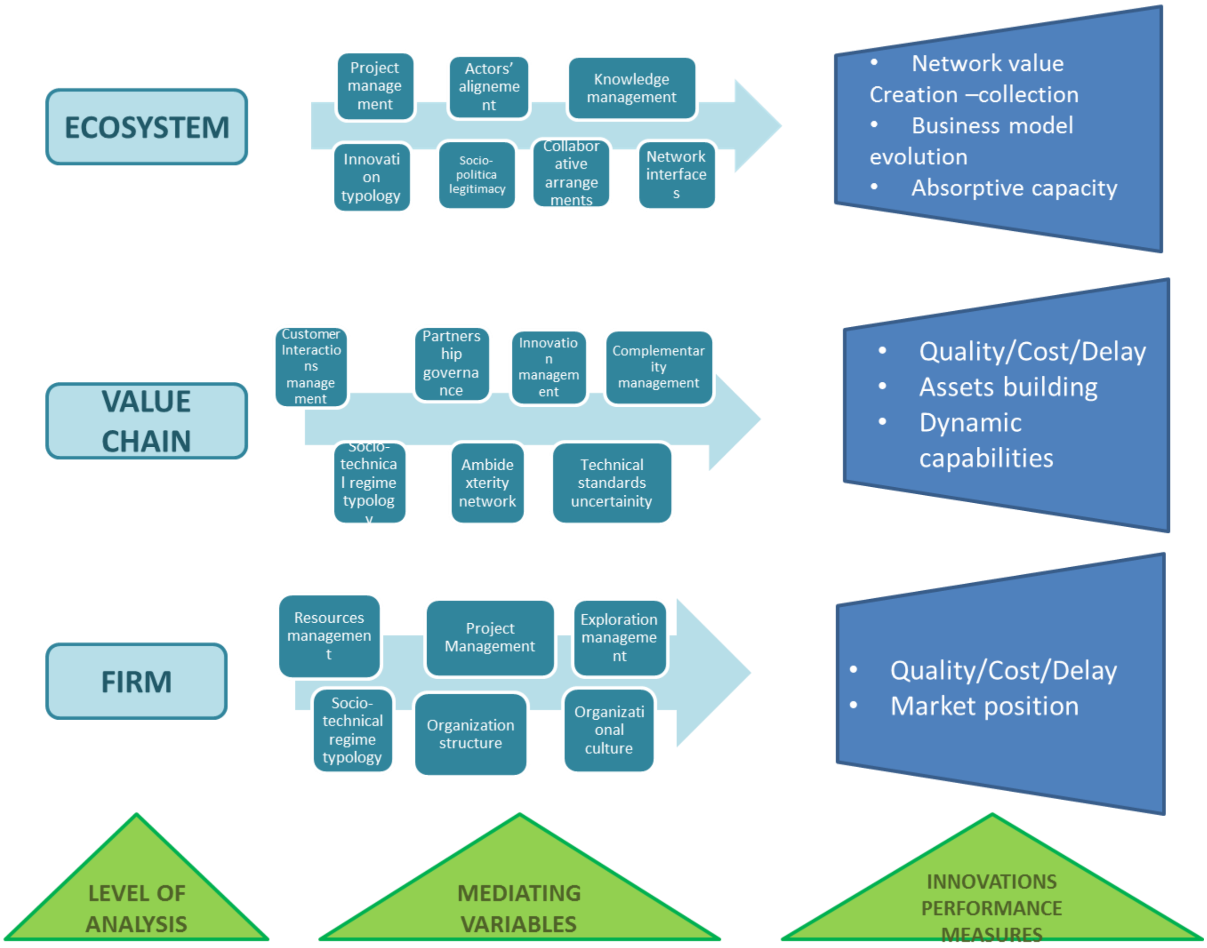
Through the Innovation Management and Strategy literature review, we acknowledged the mediating variables (Baron and Kenny, 1986), related to the impact of independent variable, such as the firm, toward the dependent variables such the factors toward sustainable competitive advantage achievement.

Literature elucidates us on the evolution of mediating variables and the width of their application field. We note that from internal management of variable such as project, resources management, organizational structure and culture, the platformization of the economy drives firms to move toward the consideration of the same factors but in cooperation with other actors, and it introduces new variables such as the socio-political regime typology and legitimacy, the knowledge management, the exploration management (including innovation typology and technical standard uncertainty) and the management of networked relationships with stakeholders in the form of collaborative arrangements, interfaces design, alignment, complementarity and partnership governance. The phase of creation of these arrangements and interdependencies is still quite underexplored, as the role of organizations structure on such phase, potentially impacting ecosystem design and value creation.

The evolution of such mediating variables toward the sustainable competitive advantage achievement in an ecosystem context modified the performance expected from innovation. From a Quality, Cost, Delivery performance based on industrial economy dynamics, firms nowadays have to evaluate innovation performance, and therefore their strategic decision-making, on the bases of network value creation, absorptive capacity and business model evolution.

A visualization of the above insights from Innovation Management and Strategy literature is presented here below, with mediating variables as processes in the upper side of the row and the mediating variables as objects in the lower side:

Figure 30 The Innovation Management and Strategy literatures insights



If we take a closer look to each literature, including the third stream of Design and Innovation Sociology, we find spots not covered yet by current academic production.

As it results from the Innovation Management literature review, the priority of research was given to management of development projects in a context of integrated firm. Project management and New Product Development were aimed at enabling firms to progressively shift their activities toward:

(i) increasingly innovative and disruptive projects,

(ii) projects involving a growing number of heterogeneous actors, as we shift from B2C and B2B perspective of action toward B2B2C, B2G, B2X and G2C

(iii) the integrated steering of development project and, at a global scale, the strategic steering of the product/assets dynamics on lineage of projects.

This stream of literature appears to provide limited input on management of systemic and disruptive innovation projects contributing to ecosystem structuring, and this lack of input from literature in such a current pressing issue generates our first research question.

1. <u>How can an ecosystem project be managed? Is there a specific pattern, and which are the variables of project steering?</u>

The second stream of literature, related to strategy, it has been focused on providing inputs for firms' survival, highlighting the relevance of assets and entry barriers building. From this static perspective, authors moved toward the dynamic capabilities consideration, and the innovation project performance evolved consequently. Innovation project performance, once related to the direct financial input of the commercialized innovation, is currently evaluated on the basis of:

(i) The management of the assets of the involved companies

(ii) The absorptive capacity generated through the project

(iii) And more globally, the impact on the renewal of the strategic agenda of the firm

Furthermore, in such considerations, literature on strategic management of ecosystems elucidates inputs related to one industry. As current innovation challenges are located at overlapping points of industries, we lack insights on how we can strategically evaluate a project positioned in a multi-industry defined ecosystem, and in a phase of ecosystem structuring. The literature on strategy provides frames to consider how a collection of players can deliver and share value, but we need more insights on the dynamics of engagement toward the collaboration among such players.
From this evolution of performance, the second research question emerges:

2. <u>Which are the most strategically performing steering processes for the selection of innovation projects related to ecosystem structuring? Which are the organizational variables and the mediating variables toward eco-systemic structuring?</u>

The third stream of literature, Design and Innovation sociology, it provides us with key elements to understand and to frame the collective action of creating a structure and to jointly enable the creation of knowledge through representations, interpretation and transitions. Literature elucidates the process to define the innovative offer system, the structuration of the deliverable for the user.

From an individual point of view, this focus on structuration of the deliverable is linked to a cognitive dimension of the activity representation (following a constructivist approach), and more generally to individual creativity mechanisms.

From a collective perspective, literature provides insights on inter-comprehension mechanisms, as innovation requires teams to de-fix and sense-making collectively. Such collective path requires artefacts and intermediary objects, as well as methodologies to drive the process of exploration, such as C-K theory and Design Thinking methodologies.

From a more general perspective, the exploration and diffusion of systemic and disruptive innovation are largely dependent on interpretation, transformation and re-interpretation mechanisms, as result of co-conception in the social sphere, including the users.

The maturation of such inputs, joint to the elements coming from strategy and innovation management literature, they drive us to question which evolutions of representations individuals and teams experience while acting in an ecosystem project, which is the cognitive path they follow. Furthermore, it appeared to us that there is an uncovered space for artefacts role assessment in partners' shared interest structuring, as they can play a role in collaborative sense-making, but not as a stand-alone object, but rather as tool of expansive interaction design. We question which artefacts help team think and share representations, how they intervene in the construction of a shared language.

The third question emerges:

3. Which are the more adequate management artefacts to support the exploration process in a context of ecosystem project?

In the aim of searching the answers to the three research questions, we design a research methodology which will be described in the following chapter.

3. METHODOLOGY

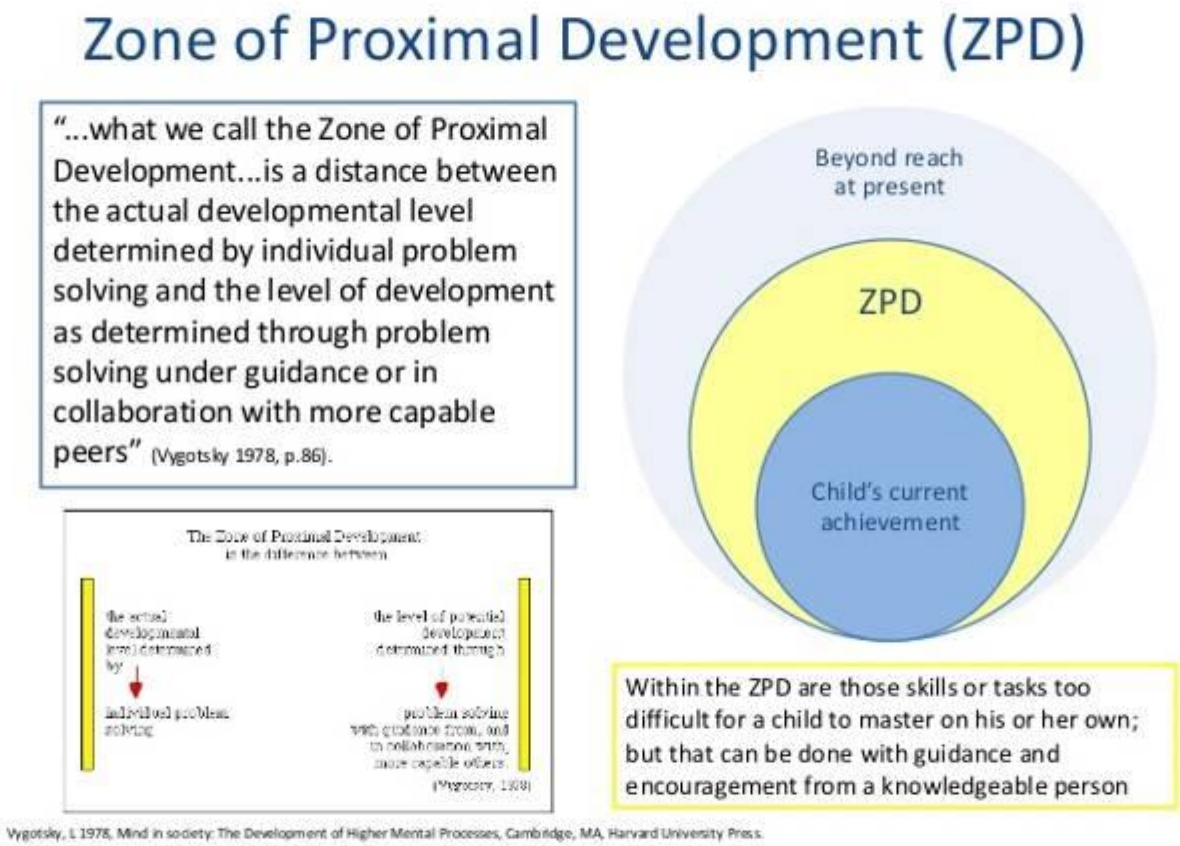
3.1 Epistemological Background

The approach followed for this research project is rooted in constructivist epistemology and in the learning by collective action approach.

The reason for such choice is rooted in the observation that, as the management science evolves, the organization becomes more focused on collective action. Knowledge and relationships are not separable and the future of management theories should consider this element as a pillar (Hatchuel, 2000). As far as knowledge construction in a social environment, individuals construct reality through collective actions, as the action of learning is the interpretation of an experience, of a language or of a phenomenon grabbed in its context (Brown et al., 1989; Lave, 1988). Activity and perception appeared to be the focus of the epistemological process, before entering the conceptualization of the resultant of them. Such sequence of relevant elements, the so-called situated learning, will allow to bypass the classical problem of reference-of mediating conceptual representations (Brown et al., 1989).

The approach of social dimension of learning in an environment where participants, creators, learners must co-create is linked to relevance of social signification of objects, as well as the relevance of language for knowledge development (Vygotsky, 1978). In the Zone of Proximal Development (ZPD) participants need each other to move forward in learning; the ZPD questions today's collaborative cognitive processes as collaboration and guidance of more expert peers might be highly valuable when facing complex and cross sectorial problem solving. The visual representation of the expansion of the Zone of Development is presented below:

Figure 31 The space of Proximal Development



Source: (Durward, 2013)

A complement to the key factors impacting the research frame to the collective action are complemented by Vygotsky's principles as complex mental processes begin as social activities, and therefore social interaction is needed through collaborative dialogues with more knowledgeable individuals in order to progress. But these considerations apply to the realm of existing knowledge to be acquired. The aim of our research work is to investigate such considerations of collaboration toward the creation of new knowledge in a changing environment.

The above elements are rooted in the characterization of the collective action as a mutable object, and the firm is one form of it (Hatchuel, 2000). But firms, organizations are also defined as interaction nodes and a political coalition among actors, whose behaviors are guided by the result expected from the collective action and by individual interests and established routines (Crozier and Friedberg, 1977; Cyert and March, 1963).

Therefore management science is at the intersection between collective and individual spheres, in which human beings rationalize from intuitive knowledge (Schon, 1983). Individuals need to locate their action, as well as "*to be socialized to make do*" in a sense-making process (Weick et al., 2005); by doing so, they are continuously redefining the interpretation frame.

As a consequence, management should intervene in organizations studies as the science of representations (for the sense making) and the science of learning processes steering in a social environment. The collective action appears to be performed by individuals thinking simultaneously at a local and at a global level.

Having stated the elements determining the choice of the constructivist perspective, we can define which specific frame we wish to use for analyzing and comprehending the empirical phenomena to be observed. The focus will be the management situation in which organizations are involved. We embrace the management situation definition as strongly characterized by the collective action; such action is intended to be the consensus goal achieved by individuals taking part together in an action in a space for a defined time (Girin, 1990a, 1990b). Taking the perspective of the management situation, we assess how the organizational processes and structures are affected and how they affect the management situation, including considerations of the participants' engagement, the interpretation frame and the resources selection toward action.

Such choices are coherent with our motivation to engage in the research project. Our interest in the research subject started before the research project kick-off, with an existing pain, personally felt in the empirical field, as lived management situation. The lack of coherence between the evolution of the value network and business model in relation with the experience-driven value proposition and the management practices of industrial incumbents was a daily litany. Once we approached the experience design universe, we became even more convinced that this shifting in value creation and capturing network was related to an entire ecosystem and not only to a linear relationship among actors. Beyond the extension of the application field, un-definition of the elements was at stake. The missing definition of offer and demand systems generates the uncertainty of conditions for value creation. The first step was then verifying if the pain was currently relevant from the academic perspective of existing literature. Our aim is to nourish both, academics and practitioners with the result of the research, and contribute to organizations' sustainability based on continuous evolution of their learning frames and collective action rationalization.

3.2 Research design

Our methodology is designed to achieve a high degree of robustness, so that the results found along the research journey could be an actionable answer to the research questions, and that the methodology could potentially apply to research on ecosystems structuring beyond the mobility sector. Here below we present the main elements of our methodology.

<u>Choice of methodology and researcher stance</u>

In order to fulfill the above target in terms of research inquiry related to empirical issues rooted in the unknown, we chose the qualitative methodological approach to data collection and analysis.
The selection of the qualitative research methodology was driven by the consideration of the following factors:

- the soft nature of the data, such as words, sentences, photos and symbols, as well as the language spoken in our context, (i.e. language of "cases and contexts" and of cultural meaning (Neuman, 2013))
- the target of exploring casual mechanisms.

The logic of conducting research in our research emerged from the practice, as an iterative and non-linear path.

As we are researchers in management science, and the research was conducted while participating actively in the projects and being paid for such active participation to the research field, we can state that we are in the position of researcher-actor. The actions include the participation in the observed organizations, the analysis, the conception and deployment of tools and results formalization toward projects completion (Lallé, 2004). We are here linking the definition of our role in the organizations we observed as "*organization engineer*", whose objective is to conceive the tools supporting his research, having a double role of mobilizator and evaluator of the tools deployment within organizations, while contributing to the emergence of new scientific knowledge (Chanal et al., 1997).

Choice of data sources

The unit of analysis is the organization taking part in ecosystem related innovation projects with high degree of systemic-ness and disruptive-ness. As the exploration and deployment of such innovation take place in the ecosystem context, we chose to observe complementary projects related to the structuring of one ecosystem.
The inductive multiple case study methodology (Eisenhardt, 1989; Yin, 1994), was chosen and the number of cases was defined in order to add validity to the results on strategies adopted by one single firm or consortium. Case study has been known as an effective research methodology for exploring research questions affected by organizational context (Yin, 1994), and especially when ignoring factors that might be relevant to outcomes (Eisenhardt, 1989).
From the literature review, we focused on broadening the angle of analysis on ecosystems to the consideration of the role ecosystem's structuring can play as collective learning arena and assets development space. We also focused on how such structuring phases are managed, in order to

understand how cooperation is fostered and developed from a project management perspective. While participating and observing the projects, we provided methodologies and frames to contribute to the effective exploration process of practitioners in the context of systemic and disruptive innovation projects involving players from different industries.

Introduction of artefacts as tools for collective action

As stated by Moore (Moore, 1993), and supported by evidences during the observation, managers confronted with innovation challenges need tools to understand their logic. The effective management of observed projects needs specific tools, which should help managers to understand the logic behind the matching of a demand and offer systems in ecosystems, and therefore to anticipate the challenges of the business communities who bring innovation to the market. During the project observation, the need of tool creation and implementation appeared as a way to overcome management challenges managers face in systemic and disruptive innovations. Such challenges changed over time, starting from formally stated project profitability, and the chicken&egg problem solution to a wider panel of obstacles identified during the research project.

As per the above elements, design appears to be a complementary discipline to enable players dealing with unknown and fuzzy collective future services. From the operational points of view, different processes and tools had been used during the project development, in order to improve the collective action and the process of alignment. The design and use of artefacts have been specific to the context, as « *le milieu ou l'environnement, qui comprend tout ce qui n'est pas strictement technique, joue un rôle crucial sur les directions prises par l'évolution des techniques, elle-même régie par des règles internes qui déterminent le champ des possibles*. »(Simondon, 1958).

Their use has also been described as enabler of coordination among actors; artefacts as boundary objects allow the matching of general conventions and personal conveniences (Akrich, 2006).

As literature identifies artefacts as relevant tools for collective action toward partners' alignment and knowledge sharing, we decided to investigate which artefacts can better serve the purpose of managing systemic and disruptive innovation exploration projects toward ecosystem structuring. While participating to the projects, we proposed several tools, such as frames, formulas, processes, sketches, videos and mood-boards in order to contribute to the collective action of partners and to evaluate simultaneously which tool at which moment of exploration impacts such collective action.

As far as processes, we introduced an iterative process, the Significance Prober process, used to overcome the chicken&egg problem in platforms, and we applied a methodology based on two different design paradigms as exploration methodology for the highest level of disruptive-ness and systemic-ness in innovation.

The iteration of both process has been designed in the aim of helping actors to structure their beliefs in the opportunities to be built around significance of signals (Cohen and Levinthal, 1990) in an unknown field.

As far as process of exploration, in the Square project we define to apply a methodology derived from a merging of two design approaches to exploration, in order to face the challenge of high degree of systemic-ness and disruption of the project.

The overall frame of the exploration is derived from Design Thinking, with the introduction of the C-K derived tools in the Definition and Ideation phase. Such choice aims at complementing two design approaches to exploration, the user-driven methods in which users introduce the values to be designed for and the designer-driven methods in which the clients and designers are introducing these values.

Design Thinking has been selected as it is recognized as an unconventional approach to problem solving, achieved through the incorporation of user observation and human behavior study into design process. The empathy is the key factor in order to get human centered thinking, the first step to 'Design Thinking' and the collaborative dimension of the consequent problem solving achievement. Historically originated by IDEO's founders, Tom and Kelley, the Design Thinking process targets to deliver products and services meaningful to people. The 5-step process widely applied can be characterized by the following main teamwork-user interaction phases:

- To put together people from heterogeneous academic and professional background and get them to brainstorm. Starting from a given problem and draft of object description, building on each other ideas is the main challenge of this brainstorming phase
- To watch people and observe how they use things. The goal is to understand people through observation. The immersion step is essential in order to make the "empathization" process to start, and the team needs to be into the situation, live it.
- From the emphatization step, the definition of the solution to an identified problem is searched by the team, and explored in terms of ideation.
- In order to involve the user in the final formulation of a product or service to be fully accepted by them later, the solution itself becomes concrete through prototyping and testing.

Design Thinking has been proved to be a performant exploratory process in case of problems characterized by open-end difficulties given by the lack of resources, and by the generalized consequences of globalization (Brown, 2008).

The choice of C-K theory for the definition and ideation phase is linked to the role the theory has in exploring the unknown in case of highly disruptive innovation. C-K theory allows not only to approach the design process as knowledge generator, beyond the capacity of innovative problem solving, but also represents a theoretical model for product/services identity renewal (Le Masson et al., 2010). The theory is based on the existence of two interdependent and expandable spaces, the Concept and the Knowledge spaces, with different structures and logics, and on the dynamic interactions of them performed by four design operators. The structure of these two spaces determines the core propositions of the theory.

The C-K theory addresses the collective dimension of the design goal in an innovation process, which should involve the value creation for all the stakeholders involved.

The relevance of the theory for our research purposes appears to be determined by:

- The application of convergent and divergent reasoning
- The consideration of the social dimension of the design process
- The extension of the value of the design process to knowledge generation
- The framing of the design driven innovation process within a stable structure grounded in a scientific theory

The role of knowledge generator is particularly relevant in the context of value appreciation of the design process, as the structuration of the exploration process allows the recognition of the knowledge capital built along the way, for appreciation in the context of the project and for future use.

As far as tools, we proposed and observed the use of several instruments to apprehend the complexity of the context in which actors must collaborate to find common ground on project completion. We used traditional project management tools, such as business plan, in which partners can find references to an established and accepted set of performances. Then we introduced tools generated for improving the concrete visualization of the value proposition and for allowing more space for interpretations and discussion among partners. Such tools were selected as theoretically enabler of the dynamic of action and interactions among partners. The latest category, called ”Open Tools”, includes maps to progressively identify stakeholders related to the different degrees of value proposition under construction, value chains, value networks and ecosystems visualization, mood-boards, 3D model.

In the CorriDoor project for instance, we generated a frame in which we associate project partners and external stakeholders, to the different typologies of product/service generated. Each typology has been evaluated in terms of actors’ appreciation of the correspondent value proposition, on the basis of different values: direct and strategic. Each individual appreciation has been rated on the basis of three levels: low, medium and high. With this tool we aimed at highlighting the potential intake of stakeholders, such tool has been proposed for one project as a support in decision making for stakeholders’ dynamic involvement in the project.

Videos, as intended in design literature (Gentès, 2008), were specifically chosen as they can serve as sense making alignment tools derived from a design perspective as they can give credibility to the social environment while they are used. We choose to contribute to this with the design of mood-boards, as they contribute to de-fix from representation of known concepts and objects, in order to open perspective toward other disciplines and as formal and practical meaning-making (Gentès et al., 2015).

Choice of the narrative-based transmission of observations

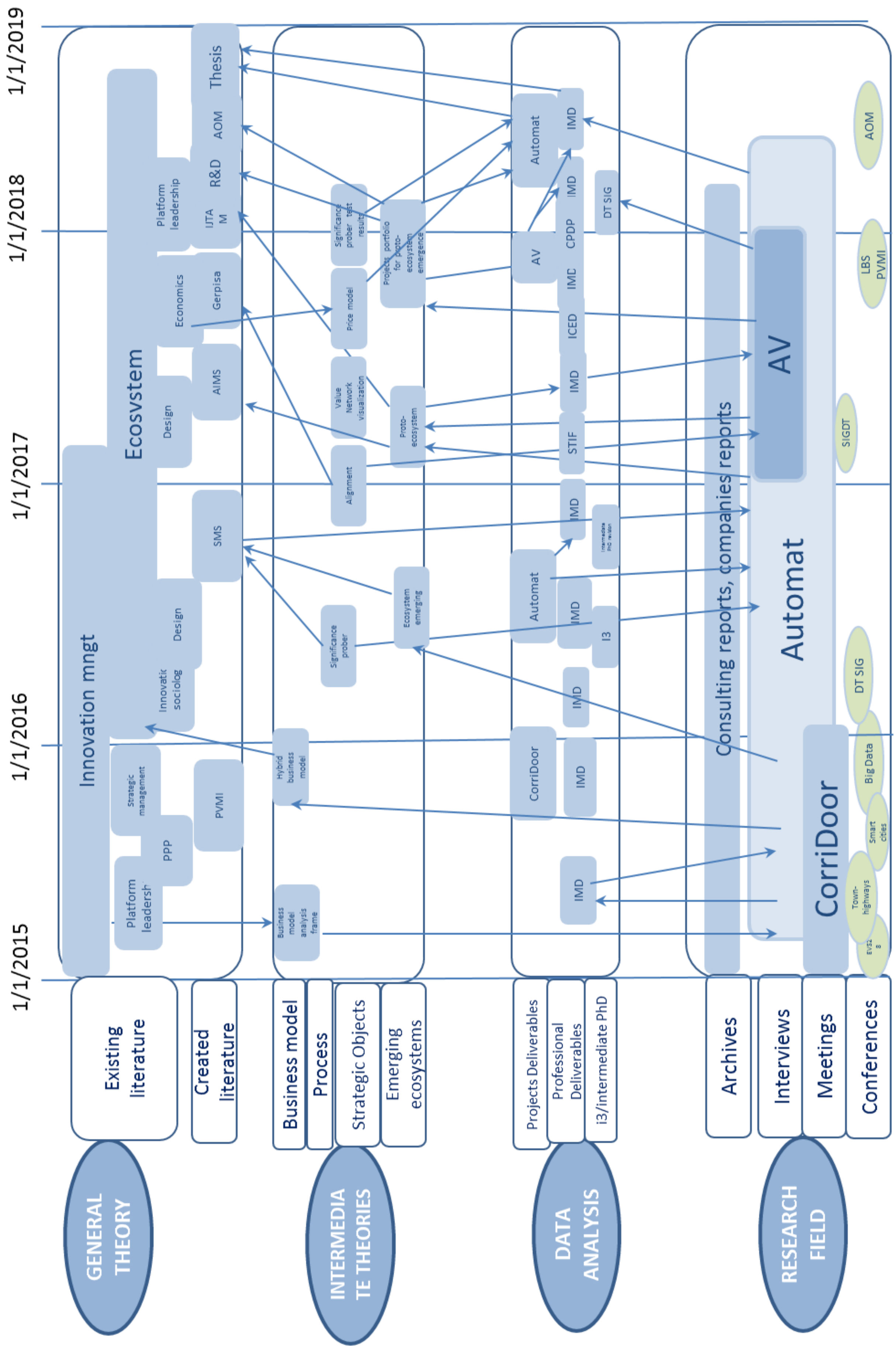
The literature highlights the role of narration as knowledge producing tool, as well as exploration and theory discussion, through highlighting the balance moments, the strengths disrupting them and the transition among them (Dumez, 2013). As storytelling is also involved in sense-making easing (Weick, 2012), we choose the storytelling as form of presenting the qualitative data.

The storytelling has been envisaged on the base of two partitions, as main driver of the dynamics detection: a chronological partition and an analytical one. The chronological partition was selected in order to render the turning points of the collective actions, while the analytical one was defined in order to understand actors' evolution related to selected factors. We started with a certain point of view, and we described the variances from the initial point Such path has been chosen in order to avoid the risk of circularity (Dumez, 2010).

Research journey as iterative process and resulting academic production

There are three elements to be considered for framing the projects: theories, data collection and analysis. The phases of collection and analysis have been intertwined, and not sequential, which contributed to the re-definition of what we were observing and on how we were observing it. The described intertwined process is visualized below.

Figure 32 Research phases



The above overall frame of research journey highlights the pace of field-input and progressive assessment we performed. Several moments of dialogue and debate on intermediate results have been created, through the participation to academic conferences and the submission of papers to review. The papers presented in academic conferences and the papers published are presented in the frame below.

Table 5 Academic production list

Paper	Conferences/journal
Marcocchia, G. (2018) "Value creation in mobility ecosystems: What is the role of organizational structure?"	Academy of Management Conference, Chicago, IL, USA
Maniak, R. Marcocchia, G. (2018) "Open Innovation For Systemic innovation: Insights From Three Projects"	**R&D Management Conference Milan, Italy**
Marcocchia, G., Maniak, R. (2018) "Managing "Proto-Ecosystems" Projects – Two Case Studies From The Smart Mobility Industry"	International Journal Automotive Technology and Management 18(3):209 (DOI: 10.1504/IJATM.2018.10013849)
Marcocchia, G. Maniak, R. (2017) " Managing "Proto-Ecosystems" Projects –Two Case Studies From The Smart Mobility Industry",	**AIMS Conference, Lyon, France**
Marcocchia, G. Maniak, R. (2017) "The ignition of auto-mobility ecosystems projects - Insights from three case studies"	GERPISA Conference, Paris, France
Marcocchia, G. Chen, B. (2016) "Innovation Ecosystems and Public-Private Partnership for Sustainable Mobility"	SMS Strategic Management Society" Berlin, Germany
Maniak, R., and Marcocchia, G. (2015). "Connected vehicle and new value chains."	PVMI-CAMI Research Conference, Isola de San Servolo, Venezia, Italy.

As shown in Figure 33, the participation in the field and the progressive data analysis, based on which papers were written, were intertwined with the participation in academic and professional conferences in which results and reflections were challenged by academics and practitioners. Being speaker to events such as Design Thinking round table at Abbe Grégoire Innovation days, the workshops on autonomous vehicle organized by ICED and by STIF, they all contributed to the maturation of data assessment and added elements to add robustness to the results.

This traditional academic process has been intertwined with the production of academic outputs for professional use as projects deliverables in the case of H2020 projects and as Actionable insights for the Axe 2-Business Models of research of the Institut de la Mobilité Durable.

The preparation of projects and IMD research deliverables was the opportunity to regularly crystallize temporary results, to step aside the projects in order to get feedbacks and comments nourishing further actions in data collection and analysis.

3.3 Research field choice

The selection of the mobility industry as research field was driven by exogenous and endogenous considerations compared to our position. The exogenous reason relies on the rising of strategic management challenge to the mobility industry, as it experiences a high level of disruption in use and of systemic-ness in offer construction with projects relating private, public actors and communities of users. This stands as a key moment of the automotive industry, which had been able for more than a century to protect its value chain compared to other industries (Jacobides et al., 2007), giving power to the integrator (Jacobides and MacDuffie, 2013; MacDuffie, 2006). However with the digitalization of the increasing connection among the vehicles, their users and the environment, the automotive industry pillars shake. Innovation projects effort progressively shifts from embedded technologies to electro-mobility and autonomous mobility systems. Every carmaker engaged in providing integrated mobility solutions, not only products, must team up with players coming from the data industry, local public authorities, car-sharing or taxi operators, legislator, competitors, etc.

Public authorities like the European Union are also very concerned by the autonomous connected mobility, since they wonder about how to help old industries (like automotive) shifting to this new digital world, saving and creating job, creating economic growth, and trigger positive environmental and network externalities.

Furthermore, users' communities are taking a relevant role in the conception and deployment of innovative services related to digital-empowered platforms, which results in an increasing number of partners-stakeholders to consider when defining strategy based on systemic and disruptive innovation management.

The second consideration is endogenous to us, the researchers. As inner motivation is a precious fuel to drive focus in such challenging personal journey as the PhD, we felt a high level of coherence between a) the personal interest on the evolution of the way humans interact with and experience highly technological objects, such as transportation means, toward increasing freedom, quality and sustainability of movement in a given environment, and b) the academic research on mobility ecosystem generation.

The relevance of strategic actions to be formulated on the basis of a wider and more flexible approach linked to innovation practices was directly experienced by us in the context of previous professional experience in the transportation sector. Leading the development strategy of a global player in transportation design, we "dove" through the limits of the traditional focus on vertical and mono-sector value chain. Traditional instruments of market potentiality capturing (such as marketing studies, provisional business plans, traditional linear value chain oriented business models), so relevant for strategic decision making, were not adapted to the liquid context of demand, technology and regulation evolution applying to platforms on which a new ecosystem could generate a significant, collaborative and sustainable value proposition. We felt the need of a conceptual journey in order to contribute to the need of the paradigm change in the factors to be considered for the evolution of business strategy. Furthermore, organizational design in terms of processes and functions divisions didn't seem adapted to opportunity capturing in terms of systemic and disruptive innovation exploration and deployment.
The choice of the projects was made on the basis of their complementarity in structuring the ecosystem of the autonomous connected vehicle, with relevant impact on soft and hard infrastructure enabling the deployment of services supported by such vehicles.

Observed cases have been chosen in order to contribute to the theory on ecosystem structuring and management, and to innovation management when dealing with an increasing level of systemic-ness and disruptive-ness.

The observed projects are characterized on the basis of several variables, as shown in the following table:

Table 6 Project Characterization

	EV Fast Charging infrastructure	Data Marketplace prototype	Autonomous Driving vision
Duration	Early 2014-Dec 2016	April 2015-April 2018	January 2017-March 2018
Goal	Commercialization of a service through the deployment of 200 EV fast charging stations along the highways network	Exploration validation through the creation of a prototype of marketplace for car-derived data transactions and service creation	Vision creation of urban applications of autonomous driving through the knowledge sharing and co-construction using design methods, prototyping of object and of service
Category	Service	Product	Service
Context of direct action	National (national territory)	European	National (local-cities)
Partners	Private+Public: Four OEMs, one utility provider, one service provider, one academic institution	Private: Three OEMs, two service providers, two privacy IT and cloud operators, three management and academic institutions	Private+Public: One OEM, one tier one supplier, one graphic design agency, one experience design agency, local authorities, public service provider, one academic institution
Typology of partnership	formal- consortium contract	formal- consortium contract	informal-target principle based collaboration agreement
Industry perimeter	Transportation first, energy management as second step. Local dimension	Transportation first, vehicle use optimization, local and European perimeter dimensions.	Transportation and logistic first, ressource management as second step. Local dimension
Project leader	Public: one entity, Utility provider	Private: one entity, One OEM	Private:two entities, One OEM and one Tier One supplier

Furthermore, the projects were assessed in terms of three variables for comparative positioning: the systemic-ness, disruptiveness and digitalization degree, compared to other projects in the transportation industry, such as Autolib' or Tesla, and to other industries, such as for instance the oil industry and the aviation industry.

The systemic degree has been evaluated on a scale from 0 to 50 based on the number of participants to the value proposition. There are four main levels related to this dimension: the first one is the individual firm building and delivering the value proposition; the second and further levels are characterized by the number and typology of participants, from two private partners, to several private partners, to several private partners and public actors.

The disruptiveness degree has been assessed on a scale from 0 to 50, on the basis of four levels of disruption related to the product identity, functionalities and attributes. The levels are the following:

- Improved existing functionalities
- Change in attributes, added performances

- Value proposition changed, new performances, same object identity
- Object changes identity, completely new relationship to it for use, new performances

The digitalization degree has been assessed on the link of organization activities enabled by communication media (internet, using digital signs) (Castells, 2010).

The consequences of considering the third dimension, the digitalization degree, are formulated in the following imperatives:

- To rethink the concept of place and materiality,
- To consider new flows of capital, culture, commodities and people,
- To center business activity on information management more than in manufacturing
- To progressively operate sectors' convergence

The characterization of the degree has been performed by assessing two questions:

1. Where is digitalization performed?

a) Inside- processes and or capabilities

b) Outside- offer to customers

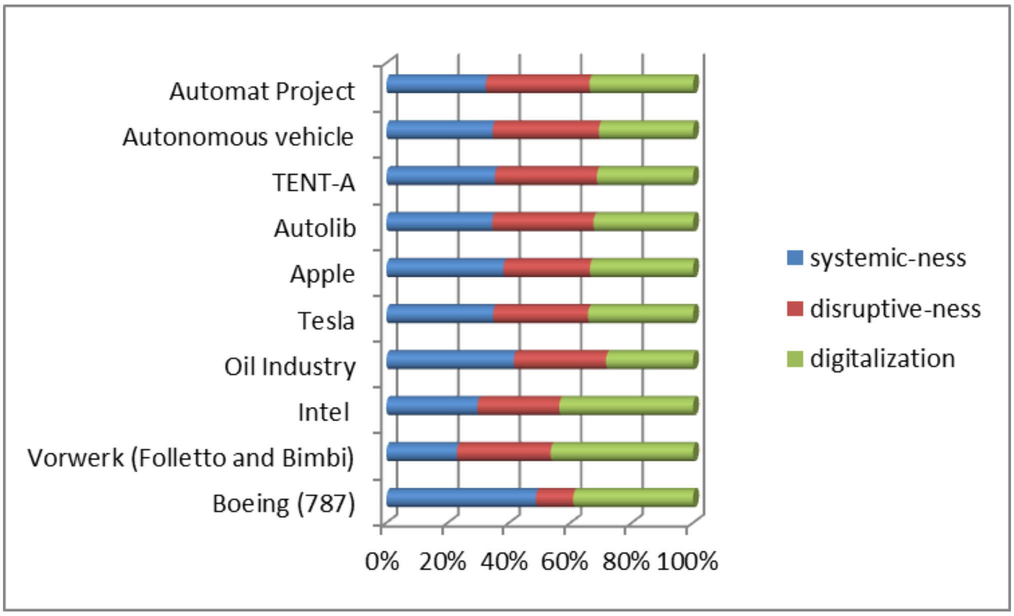
2. How it is performed as far as Activity:

- Presence and use of connected devices
- Data collection
- Data analytics and use
- Player in analytics, mobility, social networks, cloud computing, IoT

The reference degree selected for the purpose of such digitalization assessment has been the Digitization Index introduced by PricewaterhouseCoopers in 2012.

The Results of systemic-ness, disruptiveness and digitization assessment among projects of similar and different sectors are presented below:

Figure 33 Systemic-ness, Disruptivenss and Digitalization degree



Source: (Marcocchia, 2016)

The evaluation frame is presented in the Annexes.

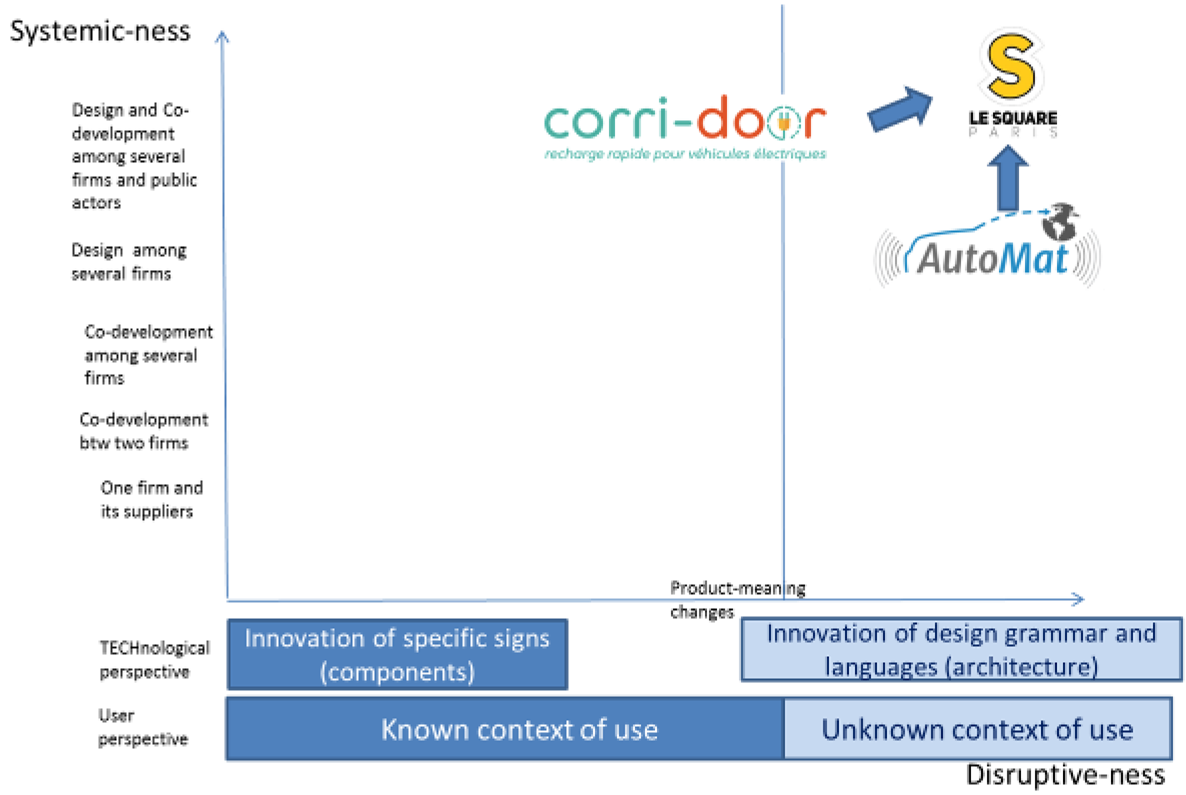
From the above figure, we can appreciate the relative weight of each dimension per project. Such assessment should provide an indication on which theoretical frames are relevant for the management of the chosen projects, compared to widely known case studies such for instance Intel and Boeing 787.

An additional and complementary characterization of the projects has been provided on the evaluation scale defined by the design approach, depth of innovation and distance of the context of use.

Based on the literature review, systemic-ness can be evaluated on the basis of the number and typology of partners participating to the creation and development phases. On the other side, the disruption degree can be assessed on two sub-dimensions: the context of use and the impact on product structure (signs, grammar and language).

The result of the assessment is presented here below.

Figure 34 Research field mapping from design point of view



From the two above characterizations of the projects in terms of systemic-ness, disruptiveness and digitalization, it appears that the selected projects are coherent with the intention of observing the novelty of challenges partners' face in today's competition. They also highlight the level of disruption from technological and user perspective requests the consideration of frames for cognitive analysis in order to capture dynamics at individual and collective levels.

Having acknowledged that, we opted for an active role in the research field as the most suitable for the collection of significant data.

3.4 Research role in the projects

In all the projects selected as the research field, we participated as active contributors to project completion and responsible for a part of the deliverables, in coherence with the "research-action" approach described in Chapter 3.1.

We were involved in the projects as business model academic and design methods expert. We participated in all European consortia meetings in the case of the Horizon 2020 projects and in the weekly meetings of the Square project. Besides the traditional tasks of a researcher in observation for data collection, we organized and animated seminars/workshops acting as facilitators and we moderated creative and brainstorming sessions.

For CorriDoor and Automat projects, we were responsible for business model analysis. Our task was to analyze existing charge services and related business models, and to investigate in the innovation management literature which elements should be considered for driving the viability of the project business model. We conducted interviews, organized and or animated seminars/workshops acting as facilitators and or moderators in brainstorming sessions dedicated to value network and business model design. Our involvement covered the whole project duration.

For the Square project, we were involved as co-managers of the design process followed by the team, and as business model designers once the creative development leading to the concept definition was concluded. The task we were involved in were providing elements of inspiration and reflection for the team, injecting knowledge and guidance in terms of innovation exploration through design theories and methods (C-K theory and Design Thinking methodology). While the concept definition progressed, we provided more elements on business model design, value chain and value network definition in an eco-systemic context. We participated in the team meetings, conducted interviews and participated in service design workshops. Our involvement in the project began in early January 2017 and ended a year later in early January 2018.

3.5Data collection

Data collection included notes and recording files from the participation in the H2020 Consortia Committees and from the weekly meetings for the Square project, interviews with partners and project-related stakeholders, participation in international symposia on smart cities, mobility and big data-driven innovation, consulting reports on topics related to the research question, and field notes. We chose to collect data from various sources in order to support the process of data source triangulation (Denzin, 1978; Patton, 1999), in order to develop a comprehensive understanding of phenomena (Patton, 1999). Such comprehensive understanding should contribute to creating a solid support to the interpretation confirmation of the results found.

The variety is needed for the nature of the phenomena we decided to observe, as they are social phenomena, and the nature of the innovation, systemic and disruptive. We seek to build the robustness and the reliability of the research; abundant and varied data add representativeness. Furthermore, the analysis of meaningful information could drive the identification of new phenomena (Eisenhardt, 1989; Yin, 2003).

Triangulation applies to reliability, validity and generalization, aiming at rigor in qualitative research (Tobin and Begley, 2004), and also to theory, collection and analysis described in the precedent paragraph.

Collecting a large variety of relevant data should contribute to increasing the validation of paradigm and hypothesis (Eisenhardt, 1989). Relying on these data, we followed a process analysis creating (and recreating dynamically) a narrative of how things (Dumez and Jeunemaitre, 2006)– organizations, people, opinions, objects, etc. – evolve over time and why they evolve in this way (Van de Ven, 1992).

In the aim of contributing to theory following the process illustrated by Eisenhardt (1989), case studies were selected as "particularly suitable for illuminating and extending relationships and logic among constructs"(Eisenhardt and Graebner, 2007) and adapted to new areas of emerging investigation. As we are interested in the structuring of ecosystem and eventually in the emergence of a new one, a single case would not have provided enough empirical evidence for an eventual emerging and generalizable path. Data collection has been performed following an iterative path; as projects constituting the research field had different kick off dates and different duration. Such superposed agenda of research fields allowed us a certain degree of flexibility of adjusting data collection along the process, which resulted in aligning the focus of observation to the evolution of the perimeter of interest of mobility ecosystem participants, from platform to the progressive structuring of an entire ecosystem. Data collection instruments, such as new questions, and new data sources have been added along the way, as workshops with public authorities, because they were relevant to the phenomena observed (i.e. of hybridization of business model).

The detailed data collection performed for the three projects is shown in the following table:

Table 7 Collected data characterization

	Number of meetings	Type of data collection	People	Duration
EV fast charging infrastructure Consortia steering and operational commitees	3 operational committees, 7 steering committees, 1 dedicated workshop	written field notes, strategic orientations and priorities, available knowledge, technology roadmap, financial concerns	EU Consortia partners (utility provider charging network manager, service provider CEO and project manager, consortium contract legal advisors, OEMs EV business units responsible and managers, academic partners)	Half a day each
Data Marketplace Consortia steering and operational commitees participation	11 Consortia meetings, 2 workshops, 2 two-day pre-EU review meetings	written field notes, strategic orientations and priorities, available knowledge, technology roadmap, financial concerns	EU Consortia partners (OEMS responsible of data management, responsible of telemetry, service provider in mapping and weather information CEO and business development managers, cloud computing managers, privacy management consultant, academic partners for technical framing of the platform)	1,5-2 days each
EU official kick-off and results presentations	1 in Brussels, 2 in Luxembourg	written field notes, EU commission priorities, available performance on current and previous projects	EU Consortia partners, European commission leaders	one full day each.
Autonomous mobility system meetings	29 meetings in Paris	written fields notes, strategic orientation, vision of futures, current available knowledge, reaction to new process	OEMs open innovation and NPD managers, Tier1 supplier innovation manager and designer, public municipality representative, external experts and potential customers	Half a day each
Conferences-Symposia-Workshops	1 in Seoul (South Korea), 1 in HongKong (China), 1 in Berlin (Germany), 1 in Venice (Italy), 6 in Paris, 1 in Vancouver (Canada) 1 in London	written notes on smart cities strategies, big data management, mobility intermodalities, automotive sector trends, strategic management, design theories	private firms, public institutions, academic institutions	couple of days each
Interviews	43	written interview notes, interviews recording, managerial considerations on strategic positioning and value chain perception	public and private stakeholders such as local municipalities, smart cities architects and actors, insurances, highway operators, Automotive and digital platform consultantinteroperability providers, fuel distributors, urbanists, International energy Agency, mobility service providers, deigital platform managers and academic researchers.	from 1 to 2 hours each

We attended a total of 58 meetings and performed 43 interviews.

Almost the total of interviews was performed as in person meetings, with only one over the phone. Among the in-person meetings, few of them were conducted as one-to-one informal talks before or after official meetings. The reason behind this choice is linked to the context on which the intervention research took place, related to specific moments of project trajectory (Automat), to the peculiar form of team definition (Le Square), or to the hierarchical position of the interviewed. In such situations, the standard interview formalism would have been counterproductive to the research purpose achievement, not maximizing the information gathering from the personal interaction with informants.

Focus of each interview of project participants was the person's own factual experience with the project, the evolution of their involvement, understanding, commitments and feelings, their own interactions with project's partners and their own firm on project matters, and their recollection of 'events' that they saw as important in the evolution of the project.

Our emphasis during the interviews process and in interview protocol design was on the comprehension of the following:

- the events within and around the participants in the context of the projects and in the context of their organizations,
- the perceptions of participants in the project target achievement and collaboration process about the ecosystem structuration.

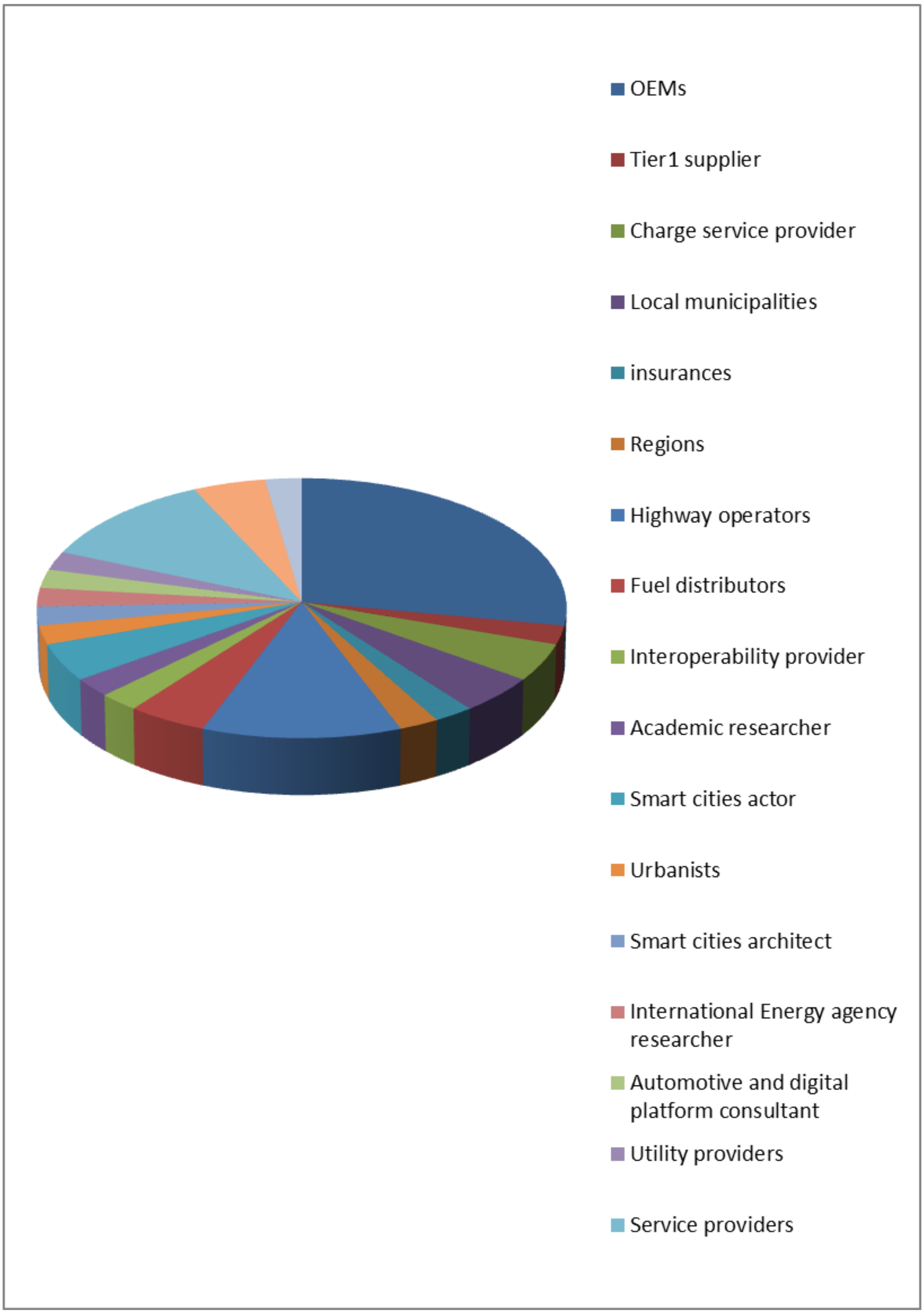
Interviews should elucidate which are the obstacles and how participants react as individuals, as part of an organization and as part of a team of a specific project.

Focus of each interview of external stakeholders was the person's own understanding of the value connection with the project, the evolution of their involvement or the potentiality of it, their strategies, commitments and feelings toward the holistic view of the ecosystem. We also aimed at investigating their recollection of events that they perceived as important in structuring a direction steering for participating or not to such platform-based projects, and which impact such decisions might have in their own organization.

Our emphasis during the interviews process and in interview protocol design was to comprehend the level of interest of external stakeholders in the project and in the ecosystem structuring, as well as which obstacles and opportunities are perceived.

The visual representation of variety of interviewers is presented here below:

Figure 35 Characterization of interviews panel



The panel of interviews is large as actors are heterogeneous by sector typology and geographical coverage. Such choice is dictated by the width characterizing the connected autonomous mobility ecosystem. We considered local and global perspectives in terms of users' adoption, technological and legal frames.

Data collection strategy is drafted in order to maximize the insights on the early phase of ecosystem structuring, aiming at mapping the evolution of interactions toward the alignment mentioned as key elements on ecosystem structure by existing literature (Adner, 2017).
Consequently, besides consortia and project participants, actors on private and public sectors were chosen as already or potentially involved as stakeholders in the connected mobility ecosystem. Actors included in the panel are:

- Automotive manufacturers, as key actors in the vehicle manufacturing, collected data management and service providing role
- Automotive Tier 1 suppliers, as key actors in technology development on connectivity sensors and data management
- Public actors, such as local municipalities, Regions and urbanists
- Digital and physical Infrastructure builders and operators, such as EV charge service providers, highway operators, fuel distributors, utility providers, interoperability providers, digital platform consultant, as key actors in allowing the connectivity operations and the creation of use cases derived from it
- Insurance providers as key representative of services transformation for value creation to be transferred on mobility users
- Smart cities actor and architect, as stakeholders in the shape of the physical environment and on the augmented experience mobility will have in cities.
- Researchers in the energy management sector and innovation management as key references in the state of the art of broad concerns in terms of innovation and energy management from a cross sectorial point of view.

Interviews took place in France, Italy, Germany, Spain, Switzerland China (Hong Kong) and USA (San Francisco). They were conducted in French, Italian or English, and were semi-structured, recorded and transcribed except for the cases in which recording was refused or not adapted to the interviewee.
The partial structure of the interviews was determined by a pre-defined set of common questions for all the interviewed, and motivated by the fact that the opportunity to interview the managers was considered not repeatable, as per (Bernard, 1988; Cohen and Crabtree, 2006). In the case of H2020 consortia and Le Square project participants, interviewed were preceded by observation and informal, unstructured exchange, which allowed to better define the goal of the interview and the open-ended questions list: The use of semi-structured interviews was also driven by the intention of setting space of expression freedom for both interviewer and interviewee in order to allow the emergence of the interpretation of meaning by social actors.

3.6 Data analysis

The chosen approach to qualitative data is the collaborative social research scheme. Researcher intervention is used as observation on the projects evolutions, as well as a ground for crafting next steps of operations. The working scheme is the collaborative action research one (Oja and Smulyan, 1989). As we are investigating the realm of unknown, animated by several actors, including the researcher as active participant to the projects, we decided to perform the analysis of the discourses as they are the practices systematically shaping the objects actors talk about (Foucault, 1969). The peculiar situation of data collection is defined by several elements: the length and the proximity of collaboration with the observed fields, the fact that data are collected along the analysis performing, and the context of ecosystem structuring while the observation was performed.

Among the procedures for analyzing qualitative data proposed by Miles and Huberman (Miles and Huberman, 1994), we chose memoing and Interim case summary. All the presentations to consortia have been performed as tools to process material at hands, to formulate clearer sense of the cases, to perform self-critique adequacy of data and planning next steps and evaluating code reformulation. Feedbacks were always received (from consortia partners and research entities). Interim reports were produced during all the duration of the projects, allowing the test of new hypothesis and of the proposed tools.

Memoing used in this research project were the research journal and the notes during the thesis discussion with PhD Director. The research journal was in the form of a word document filled all along the duration of the research project; from field observation to the last day of thesis writing, its function was to capture ideas, impressions and comments on observed situations on the spot, and to give us the opportunity to look at such impressions later on with a more distant and wider analysis lens.

The Thesis notes were also taken as word document, taped during the PhD follow up meeting, in order to report the evolution of the joint analysis of the emerging data, involving references to models or inputs from existing literature. Both tools revealed to heavily contribute to the development of the research work. They were relevant instruments to statements connections, new proposition definition, and results identification from the observations. In the case of the research journal, the memo is done for the researcher as audience, in the case of the thesis follow up notes, the audience is both; the researcher and PhD director. Interim case summaries were presented in several occasions: for the annual meeting of the i3 research laboratory, for mid-term PhD review at Telecom, for the research review meeting with the IMD and for presentations to conferences of institutions such as PVMI (Program on Vehicle and Mobility Innovation) and for SMS (Strategic

Management Society). The documents presented were aimed at informing an academic and practitioner public on what was performed and achieved so far in terms of field research and preliminary findings, with indications of the remaining research tasks. We used them to make sense of the cases along the development of the case itself, and to update the formulation of data collection and code evolutions. Interim summaries have been submitted for the analysis and comments of academic colleagues.

Tools of tabular display as proposed by Miles and Huberman (Miles and Huberman, 1994) have been used to display evidence.

The data analysis was performed as a progressive evolution of the frame initially designed, as per the path illustrated below.

Initially, we faced a methodology challenge: three different projects, but with similarities. A general characterization is therefore debatable. We decided to not apply categories to the cases, but only to describe them with factual factors on projects initial settings, as shown in Table 6 (Project Characterization). Following an inductive process, we expected to find at the end of data analysis, the emergence of categories, as explaining factors of differences, similarities and performances.

Our active participation in the research field was instrumental in collecting data in order to identify the management challenges of projects, and for later assessment on similarity or difference of such challenges.

At the beginning, three dimensions seemed relevant to monitor partners' action toward project completion in the context of the platform to be created: the systemic-ness level, the disruptive level and the platform management. The dimensions analysis supported us in the search of temporality of major changes in platform adoption and management. From this preliminary categorization, we selected categories (such as alignment, competences, process) in order to search for intergroup differences and within group similarities.

From the analysis of discourses, we proceeded with coding projects depending on two categories of strategy and management factors at partners' level. As far as strategy-related factors, we focused our coding on offer analysis, competences and roadmaps. As far as management-related factors, we observed the evolution of the processes, the product portfolio, project performances, initial concept of exploration (C0), and the alignment of technical standards, roadmap and cognitive positions. An example of such coding is presented in the Annexes. The result is a sort of "Augmented" Time Line per each project.

Reports and interviews re-transcriptions were read several times in order to capture the elements related to the research questions, and these elements were reported in verbatim frames linked to the Augmented Timeline. Additional interviews were added as complementary elements emerged as key to understand the value network structuring process.

The analysis of the augmented timeline allowed us to discover that each project went through a similar series of management challenges, to which we went back for another round of assessment. The seven management challenges found inductively became the frame to analyze the driving forces of each project.

We have then considered projects and partners evolution in order to detect which driving forces had an impact in overcoming such management challenges. From the comparison of the dynamics of driving forces and timing of partners' action in the three projects, we identified a process structured in four phases. Such a process appears to be the model for managing innovation processes related to ecosystem context.

Once the process is identified, we assessed our data on the basis of the moderating variables identified through the literature review. Projects and actors evolution should be then tested on the three following dimensions: project management and settings, alignment and knowledge management.

The similarity of path for the three projects drove us to compare such project with projects described by the literature, such NPD project, internal exploration projects and Co-development projects. We structured a comparison frame based on the following dimensions: Boundaries, Project Briefing, Coordination, Incentives and Width of impact. By filling such comparison frame, we identified the observed projects as part of a new category.

The emergency of similar mechanisms among projects drove us to cross-check simultaneously absorptive performances with factors emerged during the projects observation. Such factors are the typology of external knowledge, relationship between the consortium partner and the headquarter-interfirm distance, typology of experienced project management, Innovation typology, typology of internal organization, similar project already developed, similar project started during the observed one and in automotive, similar project started during the observed one and in other sectors.

The analysis of such results drove us to the selection of factors based on those observed and then more generally innovation projects facing the emergence of ecosystem can be characterized.

We extended the analysis of this new category by analyzing the relationship such projects have with the headquarters and their settings. We identified four typologies of projects. By the re-assessment of data and by the acquisition of new data on the typologies not directly observed, we aimed at detecting the advantages and disadvantages of each typology.

As far as alignment, we assessed the performance of artefacts in the process of alignment among partners. The introduction and use of artefacts was assessed based on the performance of use within each project and depending on the phase of the project. Performance assessment was achieved by the following path:

- We identified which artefacts were introduced and used in each phase of the narrative development of project,
- We related such timing to the 4-step ecosystem innovation project process
- We linked each artefact to the knowledge gap it was addressing
- We identified three categories of knowledge gap the artefacts were mainly addressing in their role of design space, collective sense-making and user interaction enablers. We assessed the result in terms of collective action of partners in terms of yes/no progression of the gap based on partners' action consequent to artefact introduction.

As knowledge and its influence on business activities have been identified as key to firms' existence (Conner and Prahalad, 1996) and that knowledge management is a mediating variable toward innovation performance, we selected the absorptive capacity as the key measure of performance in such area. We proceeded on knowledge management evaluation by assessing such capacity per projects and per participants. As far as the absorption capacity assessment, we analyzed data from meetings and interviews by coding according to the phases and contents per phase proposed by existing literature (Camisón and Forés, 2010; Zahra and George, 2002).
Four dimensions of the process of absorptive capacity building: acquisition, assimilation, transformation and application. Partners' performance was assessed based on their initiatives on the actions identified by the above literature as structurer of each dimension, as per the below list:

- Acquisition: locate, identify, value and acquire
- Assimilation: analyze, process, interpret, understanding, internalize and classify
- Transformation: transfer previous knowledge with new knowledge, combinate previous knowledge with new knowledge, adding knowledge, eliminating knowledge
- Application: leverage existing routines, processes, competences and knowledge; create new operations, competences, routines, goods and organizational forms

Each dimension has been considered in its constitutive elements and for each element a note has been assigned for each partner.
The notes are in a range of three degree of action in the process of external knowledge management. Below the explanation of the correspondence between note and partner's performance:

Table 8 Absorptive capacity evaluation

Partner's action statement	No action and no statement of interest in any action	No action, but statement of interest in action	Statement and action performed
Rate	0	0,5	1

Once every partner's performance is rated, we evaluated the sum per partner and per project on a percentage bases and not on relative numbers. The reason behind this choice is that we do not assume that a given project will perform better on an absorptive dimension than on the other dimensions. We want to observe performance related to an optimum 100% situated compared to an innovation development timeline, being the three observed projects at different stages of the innovation process, from design to deployment.

The full matrix with individual evaluations and totals is shown in Annexes.

As emerges from the above description, we decided to proceed with the comparison of cases for cross search for pattern (Eisenhardt, 1989), following the logic of replication (Yin, 1984). The first two cases allowed us to develop the frameworks, and the last case was chosen as suppliers of theoretical replications and extensions (Leonard-Barton, 1990; Yin, 1984). As a matter of fact, during the development of the projects, frameworks initially designed have been updated on the basis of the evolutionary degree of systemic-ness and disruptiveness of the projects.

In order to avoid confirmatory biases, the data collection was done by us, as well as the initial framework development. The evolution of the analysis framework, the comparative cross-case analysis and the consolidation of data were tested through the regular presentations to the academic community.

From a methodological point of view, the three cases offered benefit in terms of access to cross related information on partners' strategies in innovation management, ecosystem participation and partnership. The projects and the partners' link appear to be located at the same organizational level at the beginning, but some partners have other partnerships among them going on. Benefits might be related to capture insights on impact of a project in the internal organization, considering that the partnerships happen at different level (horizontally for departments and vertically for hierarchy) within the same organization.

The discussion on the analysis results should provide elements for project management and strategic decision making for incumbents facing one or more projects driven by systemic and disruptive innovation. As industrial and service sectors barriers and initiatives in innovation become porous in the mobility sector, we can face projects in which simultaneous actions at different innovation path stages are required. A methodology for transversal analysis within the same organization on ecosystem related projects might be derived from our iterative path.

Cases observation process is proposed in the form of the story telling. This choice was made based on the intention of explaining social dynamics of interaction among individuals, which deploy themselves over time, and in order to explore transitions among key moments of individuals and team action.

The following section provides the narrative of the three projects, putting emphasis on the evolution of (1) the motivation of project partners and the way they make sense and report it (2) the impact of the project on a common "business ecosystem" structuring and on each partner assets (3) the project management settings.

4. CASES DESCRIPTION

4.1 Structure of storytelling

As the three observed cases were extremely rich in terms of data and in terms of interactions among participants, we selected the form of storytelling as the most adapted tool for social dynamics evolution description. Storytelling should allow the detection of dynamics and key factors toward alignment. It is the base to understand the engagement process and the role definition for stakeholders in case of nascent ecosystem, such the one of the connected (and in the near future autonomous) mobility.

As described in Chapter 3.2, the storytelling has been envisaged on the base of two partitions, as main driver of the dynamics detection: a chronological partition and an analytical one.

The chronological partition was identified in order to capture three main moments of the project development:

- The initial setting: for each case we introduced the project by indicating the overall conditions per typology of partner, with the more relevant elements toward comprehension of the decision making to project participation. They might be tools, business models, dominant design or not, and management processes.
- The turning points of balances: we highlighted the moments of the projects in which main modifications or evolutions appeared for certain participants. Such moments are therefore not fixed or in equal number, as they depend on the project, but the typology of turning point might be of interest. At each turning point, the modified or evolved elements will be highlighted and the description on partners' attitude changes provided.
- The achievement at the end of the observation period, which coincides with the end of the project for the EU funded cases, but not for the third project.

The analytical partition was identified in order to capture actors' interaction evolution through project development, as detailed in Chapter 4, such as:

- Project management
- Governance
- Actors' relationships and collaborative attitude
- Actors' alignment

In the following paragraphs, the three cases are presented, with descriptions of key phases in projects evolutions, from project kick off to end of observation, which in two cases corresponded to the end of the project.

4.1 CorriDoor- EV fast charging network infrastructure

The case shows how various players align in order to build a networked ecosystem based on an EC funded infrastructure, which should lead to the scaling of EV adoption throughout Europe.

The electrification of transportation is linked to the technology of energy storage and energy charging, being these two elements key success factors toward the EV use experience definition and therefore adoption. Actors initially involved where OEMs, pushing for EV performances improvement on their own or with alliances, while waiting for the public institutions to provide the infrastructure for charging. Historically automotive and electricity generation and distribution industries didn't need to cooperate to convey value proposition and to insure each other profitability. But, being the cost of an EV extremely high and infrastructure on the public soil not available, the adoption of EV was low and the electrification of transportation a struggling object. Generally speaking public and private actors keep trying partial solutions, while isolated and pioneer fully private and public-private initiatives push the adoption their way (i.e. Tesla, Autolib').

The market is evolving toward a higher demand on environment responsible vehicles, and OEMs are searching for the right balance between product range evolution (with the introduction of EV through more investment in EV models development) and customers/users adoption of a transportation machine which still generate debates on price, range anxiety and charging infrastructure density. When OEMs calculate their individual ROI, their business model on EV is far from showing a positive balance toward profitability on EV sale related to current volume trend. The top-down approach so far traditionally applied by OEMs is not working on EV adoption and incumbents consider the possibility of joining or creating collaborative initiatives with complementors to service providing in order to boost EV demand. The tools for fostering such initiatives seem hard to find.

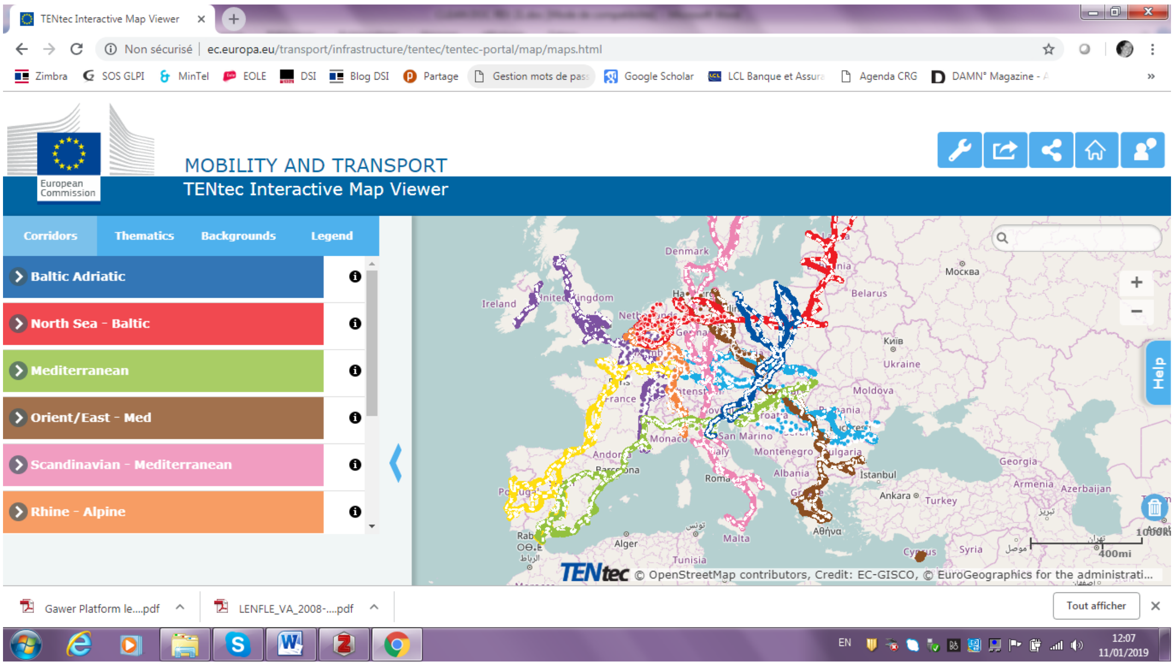
Public institutions are taking actions with local initiatives for increasing the use of environmentally friendly transportation means and services. They promoted different measures, from restriction of public space access (limited admittance to downtown areas), to financial measures (taxes positive or negative variation depending on the impact of the vehicle) but effects in EV users adoption were still limited.

Utility providers historically kept a neutral position on the EV development and diffusion, considering it among the opportunities to increase their business, but not linked to any responsibility or action to make it happen more rapidly. As EV adoption clearly appeared limited by infrastructure development, and national and international focus and priority on it occurred, such actors started to explore how to participate to infrastructure development with a sustainable investment scheme.

4.2.1 The initial setting

The imperative of environment protection pushes international institutions and national governments to fund infrastructure-related projects for moving the object forward, toward a trajectory of successful scaling adoption and widespread economic and social benefit. In order to reach significant scalability, such projects must aim at generating infrastructure coverage able to fight the range anxiety obstacle and to support seamless transit through territories. The requisite of interoperability among different territories (i.e. nations) became a *conditio sine qua non*. Trans-national financial instruments emerged and EC funded consortium-based projects among the Trans-European Transport Network, TEN-T policy. Such program aims at implementing a European network of corridors of roads, railway lines, inland waterways, maritime shipping routes, ports, airports and rail-road terminals, in order to facilitate the mobility of European citizens. The achievement of this goal in the transport sector should serve a broader goal, toward the increase of European social, economic and territorial cohesion. National participation to such initiatives has implications on national investments decision, as States are requested to coordinate national infrastructure investment policy with European priorities. Among TEN-T projects, a trans-European network for EV charging was launched, in order to cover as fast as possible a large area for EV adoption scaling. Involved countries include France, UK, Ireland, Germany, Belgium, Netherlands, Denmark and Sweden, as shown in the picture below:

Figure 36 TEN-T projects map



Source : TEN-T initiatives web portal (2018)

Once such EV infrastructure initiative was launched, OEMs, Utility and Service providers interpreted it as an opportunity to join forces with limited internal resource expenditure toward a shared effort for EV use adoption progress, having each actor contributing with its know-how and capabilities.

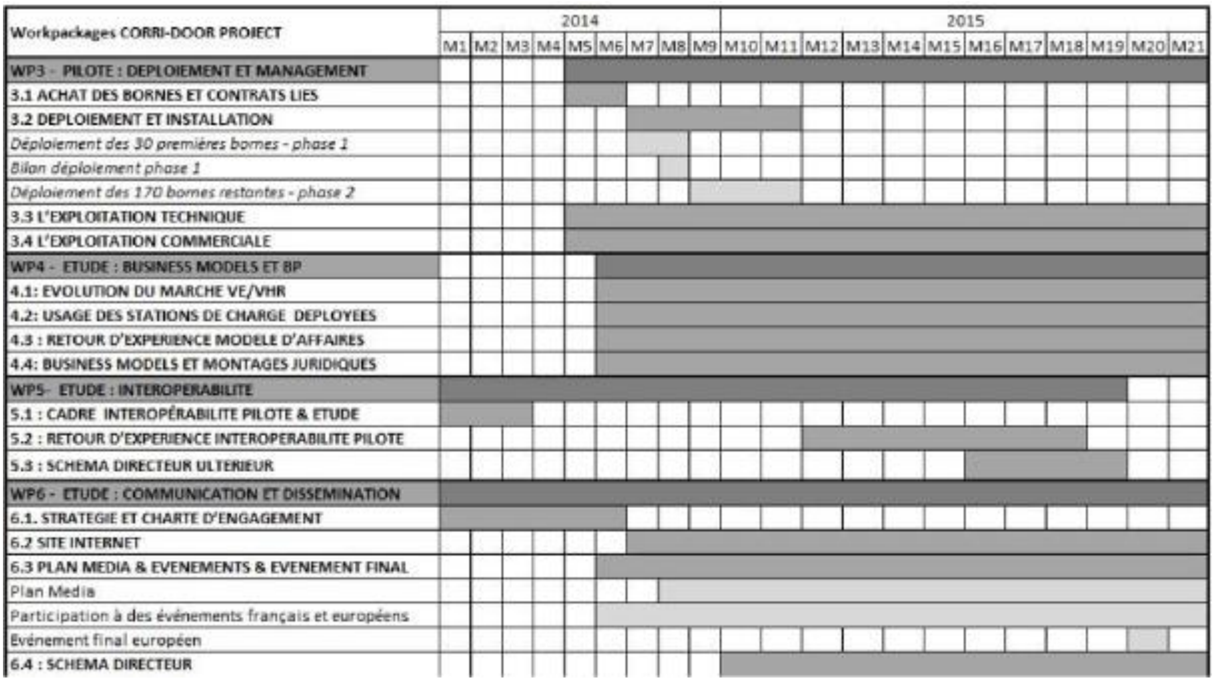
The observed consortium was the one in charge of the French territory and it was composed by four automotive manufacturers, one utility provider, one service provider and one academic institution. These organizations jointly applied one year before to the EC, answering to a call for projects in the context of EV infrastructure development. They finally got the funding. The goal set by the consortium was to implement a network of EV fast charging stations covering the highways in France and commercial areas in the vicinity of highway exits, for a total of 200 stations.

The consortium contract started in early 2014 and ended in December 2016. The project had to demonstrate that the consortium can develop a profitable private business on "charging stations" by the end of the project. This was also a condition for application. The project was framed by responsibilities and time-plan formally declared through the application document, based on which the Consortium was selected for the funding.

Activities development was divided into Working Packages, with responsible, tasks and objectives, rigidly established by a time plan with deliverable dates, as shown in the above document:

Table 9 CorriDoor timeline for all activities

Workpackages CORRI-DOOR PROJECT	2014									2015											
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21
WP1 : MANAGEMENT DU PROJET																					
1.1 GOUVERNANCE ET COORDINATION																					
Comités de pilotage stratégique (CPS)																					
Comités de pilotage opérationnel (CPO)																					
1.2 : GESTION DE PROJET																					
1.3 CONTRÔLE QUALITÉ																					
Contrôle Qualité, suivi des indicateurs																					
Contrôle Qualité du pilote																					
Audit ex post																					
WP2 - ÉTUDE : DÉFINITION INFRASTRUCTURE																					
2.1 DEFINITION DES OFFRES DE SERVICES																					
Cahier des charges des offres à déployer sur le pilote																					
Cahier des charges des offres sur les bornes existantes																					
2.2 DEFINITION INFRASTRUCTURE DE CHARGE (MATERIEL)																					
Bornes multistandards et contrats installation-maintenance																					
Sélection Fournisseurs - préparation des achats/services																					
2.3 DEFINITION DES STATIONS SELON LES SITES																					
Design des stations pour raccordement électrique																					
Design des stations de charge par typologie de site																					
2.4 DEFINITION DU SI INTEROPERABLE ET DEVELOPPEMENT																					
Choix du SI à déployer ou à utiliser sur le pilote																					
Réception et validation SI pilote pour déploiement																					
2.5 SECURISATION DES SITES RETENUS																					
Choix / optimisation des sites																					
Processus d'autorisation de travaux et d'exploitation																					



Source: (European Commission, 2013)

The governance of the project was strictly defined in the Application Form as necessary for the activities development and effective decision making. The upfront definition included the identification of four formal organisms responsible such as the Consultation Committee, the Steering Committee, the Operational Committee, the Advisory Committee, the Management Board and the Project Manager, overlooking at all Committees' coordination.

Committees' members, missions and meeting schedules were defined upfront, as the role and the responsibilities of the Project Manager. The coordination of the Working Packages should guarantee structured governance. Part of the coordination included the monthly reporting on each WP development, and "*sound*" transmission (European Commission, 2013) of information on them.

Governance of CorriDoor project includes the quality control, based on qualitative and quantitative indicators jointly defined by the partners and validated at the beginning of the project. In order to incite partner to the quality level achievement, an ex-post audit was already included in the planning.

Table 10 Project Governance time-plan and deliverables

	2014									2015												
	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Fev	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Q1 2
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	
Deliverables																						
WP1.1																						
D1.1.1 Minutes of Strategic Steering Committee																						
D1.1.2 Minutes of Advisory Committee																						
D.1.1.3: Monthly « Corri-Door InfoNote »																						
WP1.2																						
D1.2.1 Consortium Agreement																						
D1.2.2 SAP * (exact date tbd according to TEN-T rules)																						
D1.2.3 ASR (updated all along the period)																						
D1.2.4 Annual report																						
D1.2.5 Final report (Q1 2016)																						
WP1.3																						
D 1.3.1 Indicators monitoring																						
D 1.3.2 Quality control Pilot																						
D 1.3.3 Ex-post audit (external audit)																						

Source: (European Commission, 2013)

With tools such as organisms, deadlines, deliverables and audit, partners could embark the project with a well-thought setting to manage uncertainty linked to the infrastructure deployment and adoption.

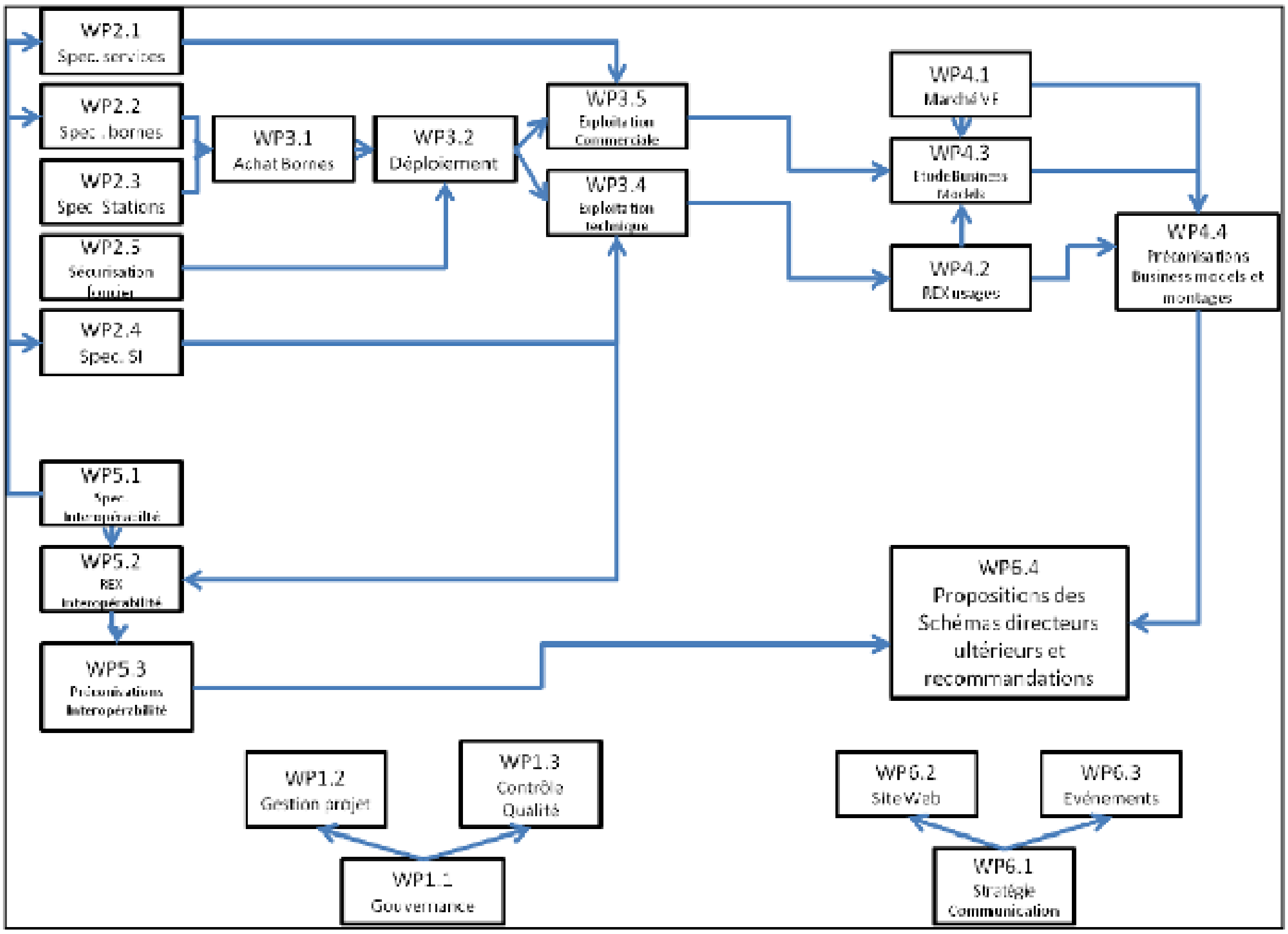
4.2.2 From project funding approval to contract agreement: Early 2014 -February 2015

Since the project funding approval in early 2014, all partners formally agreed that the common goal was to move electric mobility forward, which was a fit for every partner's internal commercial and technology roadmap.

The above activities plan was supported by a pre-established plan of resources deployment, theoretically functional to the deliverables completion. The proposition of a "Schema Directeur" for further deployment in France and in neighboring countries should have supported the goal of the EU investment, a European scaling of EV adoption through TEN-T projects.

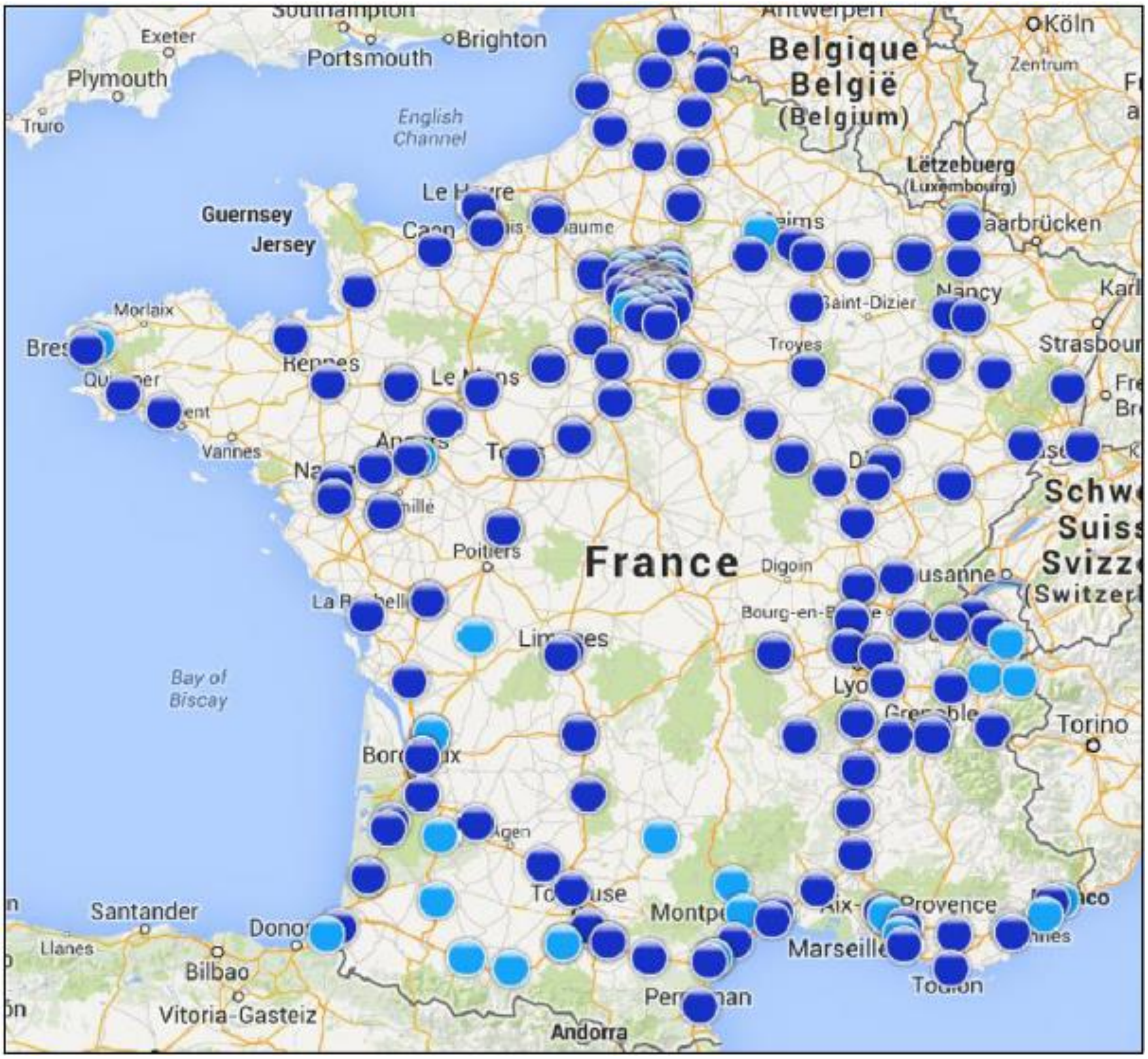
The interactions and sequences of partners' collaborations and actions were also defined upfront:

Figure 37 CorriDoor Input links among Working Packages



Source: (European Commission, 2013)

Figure 38 Infrastructure Map



Source:(European Commission, 2013)

Contract signature was the first focus of partners' discussions, but while this topic was jointly approached, operational activities, such installation partners' selection, local site verification and charging station supplier selection, were performed by the Consortium. Since the beginning of the projects, partners showed different interpretations of the requirement of interoperability, based on each one's area of expertise and professional practice. Six level of interoperability were defined, in order to coordinate test and action on each of them. The details of level generated discussions among partners, arguing that bilateral agreement among consortium partner is not against the set target of global interoperability: « *A global goal exists, but we need to test different solutions before reaching it.*" (Program Manager, Utility Provider).

Other terms originated debates, as not all partners shared the same understanding and some words might refer to technical solutions which have not matured yet, and generate confusion on potential users. This was the case of the badge to access the service, as stated by an OEM: "*We'd rather* *replace the term « badge » by a more generic one: at this stage, partners still ignore if we will use it as a support for the service or not.*"

In the first phase of the project, partners discovered that they lacked reciprocal knowledge on internal infrastructure needed for project completion, as in the case of the OEM back-ends functioning; such knowledge was completely abstruse to the Service Provider technical team.

Users' role is highlighted as the actor of the charging infrastructure choice (« *The choice of charging network will be in users' hands, if he wants to use exclusively our stations, or ours and others' network.* " Service Provider Manager, Service Provider), but no input on service definition are explored from the user's side.

Differences arose between contract negotiation and partners' internal processes, which impact project development. The disagreement on contract clauses ignited debates on vote procedure, service providers' responsibilities definition, service price and technical progression of station definition. At the beginning, partners didn't agree on the responsibility assignation in case of infrastructure failure. Different positions could merge by identifying a neutral actor, a technical expert, to assess responsibility sharing and consequent failure cost allocation. During the debate, the lack of result definition emerged as well as a problem in defining related responsibility. Through further discussions, expected results in terms of service performances were clarified.

Another discussed topic was the ownership of the network in case of financial failure of the Service Provider part of the consortium. Legal position of OEMs was then mediated by the fact that common interest is the future financial viability of the infrastructure and that OEMs will have the right of opinion on future buyers, if Service Provider was obliged to sell. OEMs interest in keeping the infrastructure operationally active in the long term and Service Provider right to sell the infrastructure in case of financial failure designed an area of common interest with divergent economic priorities. Options of partial sale of network are also considered, but without studying the impact on future operations continuity if the stations will belong to different owners.

Besides, every partner needed to reach agreement internally on moving the boundaries of contract engagement acceptability. Escalation of internal hierarchy revealed to be more time-consuming than forecasted. Every partner declared different priorities in terms of internal budget completion and related position on agreement signature: from urgency to immediate budget allocation, and therefore immediate signature, to reproach of previously unconsidered effort and engagement and therefore no pressure to action toward higher level of hierarchy for signature completion in short term. Once in front of un-recoverable delays of the project, some partners were able to obtain flexibility in internal procedure application.

A certain degree of incoherence between individual targets and EC project goal was also revealed: "*Our first worry is the network funding for our customers, and not to have a network open to* *everyone"*. E-mobility Project Manager, OEM).

Nevertheless, actions towards external partners and suppliers were taken by Service Provider jointly with Utility Provider during the first year of the project, and first charging station prototypes became available at the beginning of 2015, and the road network mapping began to take shape with preliminary indication of so far selected axes on which to position stations and station precise location. First connections to the grid started and with them, different typologies of obstacles were discovered. Technical problems and formalization of different levels of agreements were troubling the process: "*One trouble we have is the time needed to make the connection to the grid, it is longer than previous…As far as the installation is concerned, the cooperation agreement is signed by the Service Provider, and we can start installation as soon as Service Provider has the written agreement from the fuel station owners. The agreement in principle exists, but it needs to be written."*(Project Manager, Utility Provider.) The critical factors of the development became the connection to the grid and the decision making process for having the rights to start installation.

Progressively the Milestones forecasted for the project at this time and shown in Table 10 were clearly delayed. No station was deployed versus the totality to be deployed as per the time-plan; part of the locations was still under definition. Phases linked to interoperability experience, commercialization and communication of the infrastructure could not start as projected, as well as the business model assessment.

As far as governance, the decision making process related to the Working Package was delayed by the missing signature of the contract, and the level of interaction among partners was at that time lighter than the one needed to move forward the operational tasks required by the service deployment. The sound communication of individual progress was also not fully achieved, as some partners with severe delays in their WP didn't communicate clearly the status of their activities and the precise nature of the problems incurred.

Every partner defended its initial interest setting, focusing on timeline completion for return on investment target achievement, although there was no interaction among partners on direct-sale business plan parameters and hypothesis definition. Preliminary awareness of not viability of the overall frame and of the impact of public institution on project timeline completion emerged.

The need of moving forward operations on infrastructure definition pushed the partners to agree on clauses. Partners' signature process officially started. Diffused requisite of communication performance on the subject, and approaching mid-term official report to EC commissioner pushed partners to seek collaborative actions on public presences and announcements.

4.2.3 Resistance tempering by contract signature and regulation constraint: March 2015-August 2015

Since contract agreement, few operational activities were kicked off at consortium level, while a certain progress was performed on service infrastructure technical definition. The delay in station installation was due to the length of the negotiation process and Service Provider didn't seek collaboration on problem resolution toward partners. Information exchange among partners on current status of the project became vague, as detailed data on factual events was missing. Nevertheless, OEMs accorded a high level of credibility to the Service Provider and a strategic relevance of the concentration of charging network design and responsibilities under one single company, as stated by an OEM EV manager: "*We have one supervisor in this project, and this characteristics makes the project stronger, because the service is guaranteed beyond the ownership of the station. ....we only want to talk to networked platforms, and not with isolated actors. Otherwise, too much time, energy and money for unsatisfactory results in terms of customer service."*

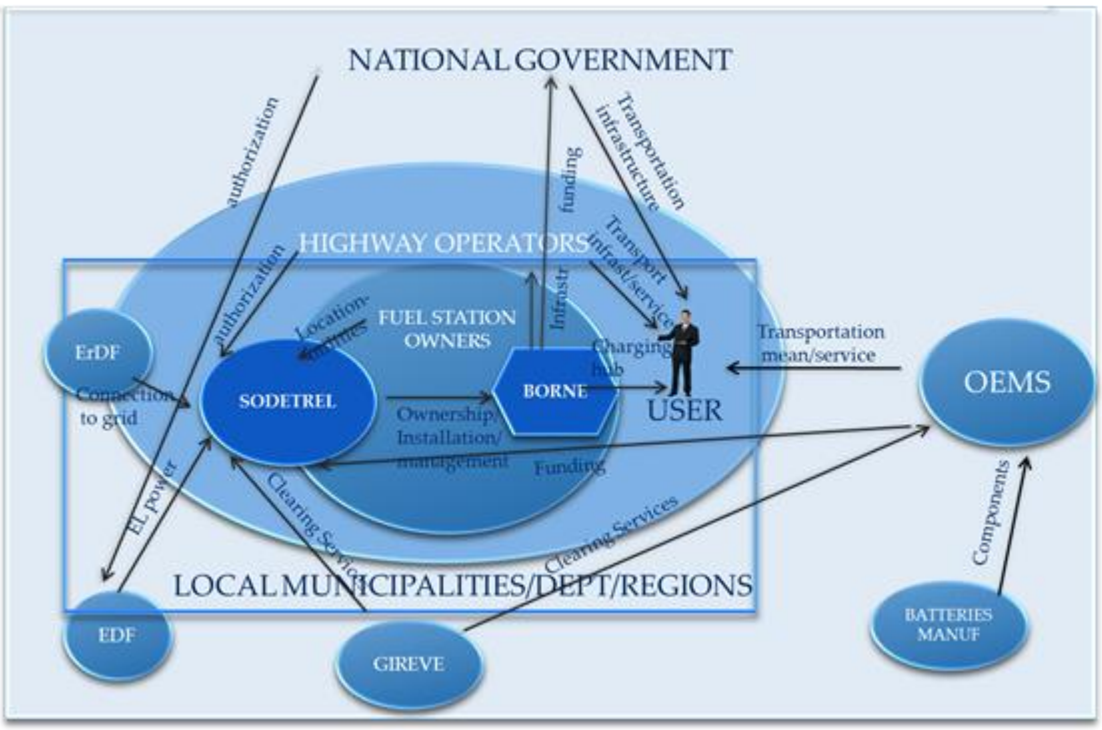
Partners started testing the available station at the beginning of March, but concerns on users' interest ignition delayed public announcement by partners until more stations were available. First feedback from EC commissioner contributed to partners appreciation of formal value of the project, as:" *Recommendations for CorriDoor's business models and legal models,…and effective communication are of very high value for EU*" (Project Manager, Utility Provider). Partners escalated hierarchy in order to be compliant with expectation on legal models and communication, while negative responses were given as soon as business questions and analysis were approached.

The kick-off of the testing activity allowed partners to identify a technical feature (RMP) of the station that was not considered so far in the station requirement specifications, but that was mandatory by law. The sudden appearance of such compliance requirement resulted in an un-forecasted heavy impact on the station design, and consequently in a delay of related project milestone completion. More resources had to be allocated to solve the technical issue in order to minimize the impact on overall target achievement and on partners' internal roadmaps, clearly perceived by all partners. Nevertheless, the Consortium still believed at the beginning of April that the installation of the majority of the stations will be performed by the end of June.

At the same time, the market assessment performed by the Academic partners was completed and provided further elements of confirmation on critical issues toward service adoption from future users.

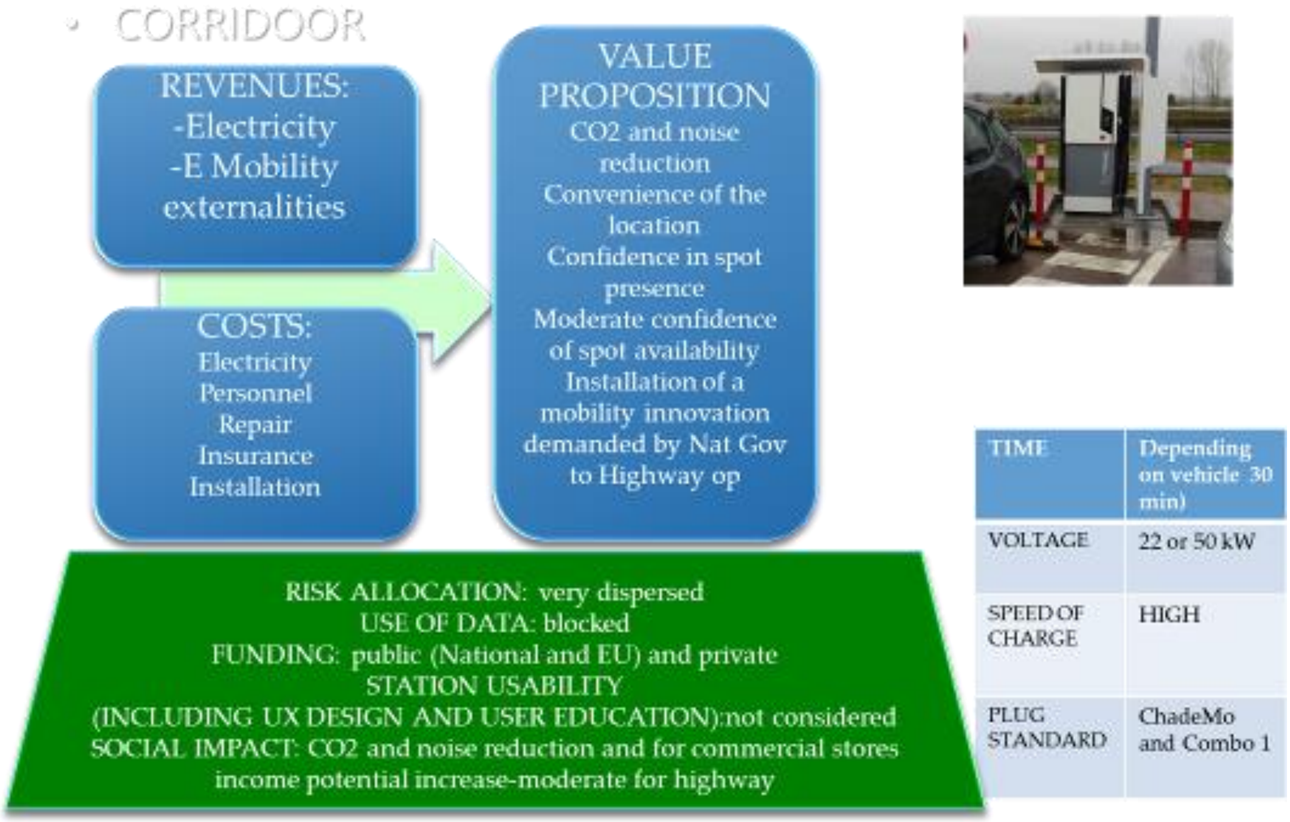
As chicken&egg problem between infrastructure investment and user adoption was confirmed, uncertainty blocked the delineation of the path to be followed for strategic decision in terms of business model dynamics, CAPEX/OPEX definition and coordination among partners. First attempts to value analysis were introduced starting from the first observed research field. Researchers used visual tools in order to have partners involved in the discussion of the value generated by the innovation projects they are involved in. In the three observed cases, all partners initially faced difficulties in adjusting the value creation approach from industrial to digital environment. The initial visualizations of value mapping were presented with two units of assessment, the network roles and the charging station as a basic unit of offer functional flow. The tools presented at this stage of the project are reported below:

Figure 39 CorriDoor offer functional flow



Source:(Maniak and Marcocchia, 2015)

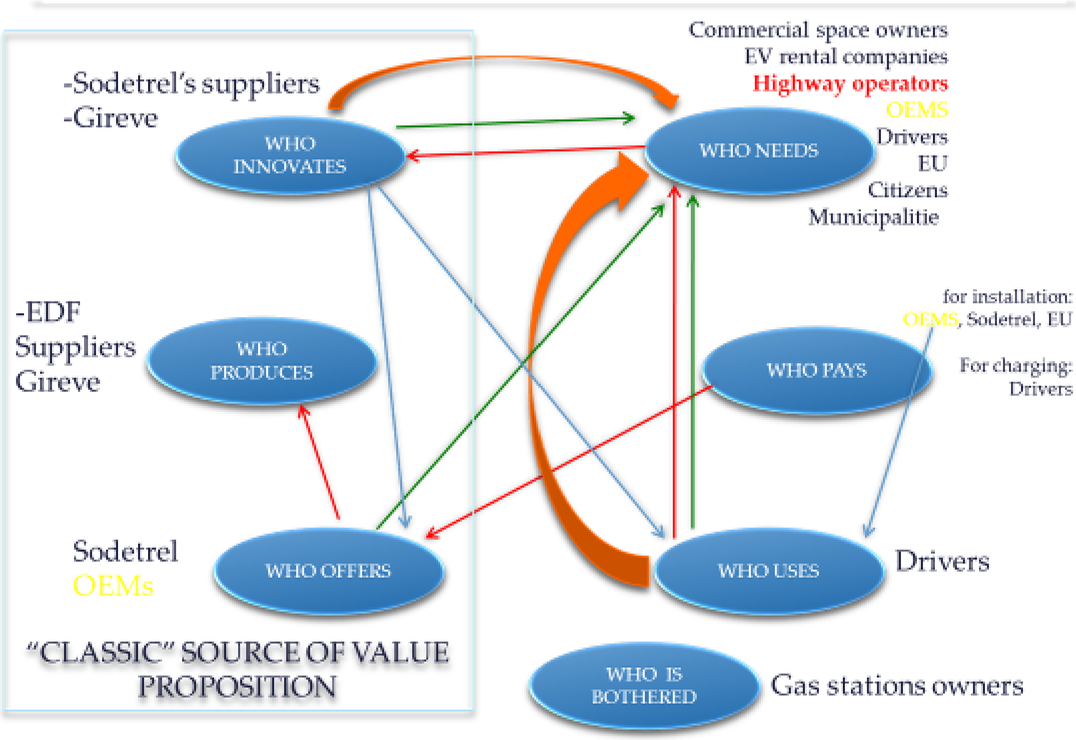
Figure 40 CorriDoor charging station ID card



Source: (Maniak and Marcocchia, 2015)

The relationships among actors in the networks were visualized through the typologies of interactions, where colors represented differnt transfers, as red for money transfer, green for environmental value transfer, orange for social value tranfer, blue for technological transfer.

Figure 41 CorriDoor consortium roles and value transfers



Source: (Maniak and Marcocchia, 2015)

Tools generated discussions among consortium partners, as the charging station ID card challenged its consideration as mere outlet for power, and different typologies of value transfer were not considered as part of the economic assessment of the project by each member.

As part of the overall EU funding scheme of charging infrastructure TEN-T projects, mid-term workshop among national projects' manager was the occasion of reciprocal updating on project completion, obstacles and interoperability features. The processes of grid connection, of stakeholders' agreement obtaining on each location, and of new infrastructure features definition (such as RMP and interoperability compliance) were universally acknowledged as more complex than initially forecasted and defined the main obstacles to project completion. Exchanges on how national projects approached similar problems were performed among project managers, and a certain level of cross-fertilization among project could happen. Nevertheless, each project went through a phase of legal compliance of new infrastructure features by a negotiation process to reach shared definition of new concepts and new territories of agreement with external stakeholders, as stated by one of the partners: "*The introduction of new arrangement of places for RPM is object of negotiations, and we are working with highway operators for …lowering of the arrangement costs…The law in France is not clear on this topic, and this is putting some sites at risk.*" Project

Manager, Utility Provider. The clearly understandable, and therefore applicable, regulations resulted in a delay of time and increase of costs, but it was also part of an iterative process of learning for partners and stakeholders confronted for the first time to such issues. All the main features of the infrastructure deployment, such as stations characteristics, station locations and interoperability performances were all repeatedly redefined and updated during the project. First level of interoperability of the station with different OEMs and telecom operators through digital platform was reached at mid-term.

As far as charging service design for price and users' access, the Service Provider responsible for service deployment hardly discussed the update of the design process with Consortium partners, which expressed concerns on the level of acceptability such decisions could ignite, as knowledge on vehicle users' was more on the OEMs side than in the Service Provider side. At mid-term, once few stations entered into operations, Service Providers denied to share information on first users' feedback with Consortium partners. As far as OEMs were concerned, some expressed concerns on the lack of structure on feedback collection and report, others realized that pressure on stations installation was priority than on customers' feedback analysis during project duration. Focus of the team was then realigned toward stations' installation, commercialization and communication on the offer providers and complementors' side, with less attention to the other side of the platform (users). Communication emerged to be a goal for the project, to be compliant with EU expectation and formal requests, but also for each partners, at headquarters' level; the project contributes to a wider scope of communication strategy toward electrification of OEM product range and CSR concerns.

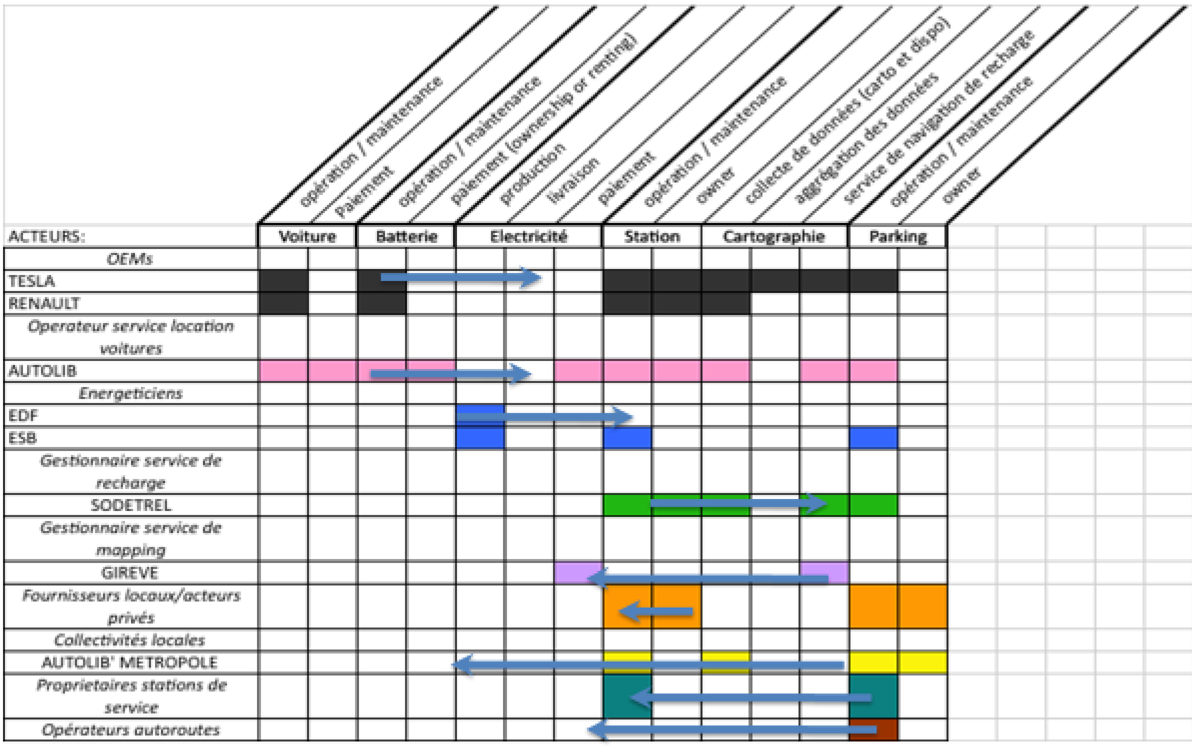
Nevertheless, a certain awareness of the value of the project for extended knowledge achievement and missing bridge toward customers was undoubtedly stated: *"Three years ago, we were in the back of the room, taking notes! There is now a good understanding of the topic at the European level; we must make sure we are making the same job at the customers' level."* (E-Mobility General Manager, OEM).

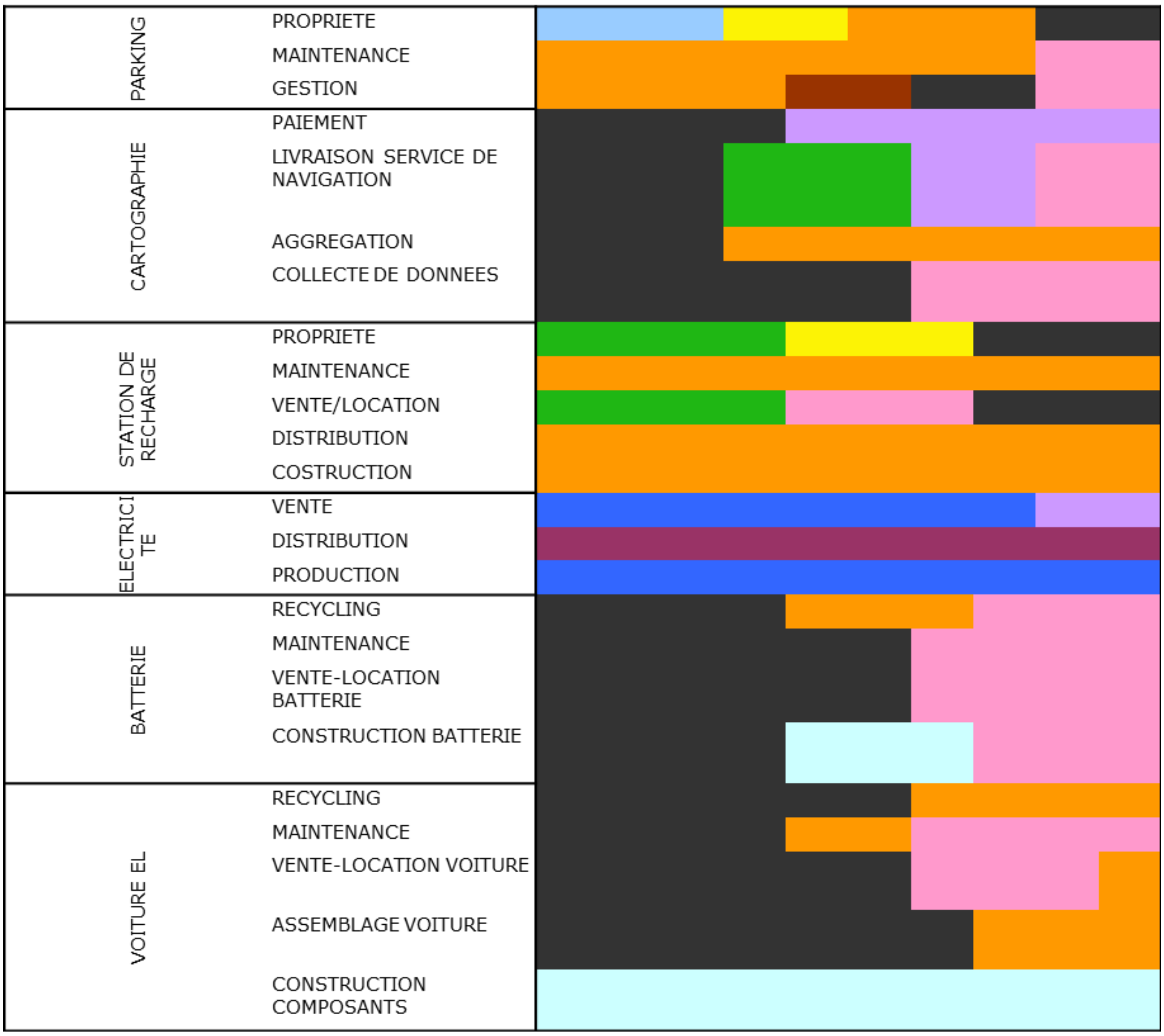
Along with the operational contingency, the simultaneous accomplishment of partners' internal process for contract signature resulted in an increased degree of flexibility of partners toward each other's, allowing sharing on project status and site negotiation process, alignment on project performances expectations starting, and cooperation in collaborative attitude in charging station testing.

Partners realized negotiation for getting the adequate conditions for each site requested an internal learning process as well as the design of new processes, and a certain degree of collaboration among partners. Different layers of organizational processes and cultures at stakeholder local sites and headquarters needed to be apprehended. On one side, the process of building a relationship with location managers paved the way for a more extended dialogue between service provider and OEMs with previous experience in such projects(as partners of other TEN-T initiatives), relationships establishment and negotiations (e.g. grocery stores). Direct request of help emerged: “*The station in Y is not in operation – it would be great if OEM X could help them in this negotiation.*” (Project Manager, Utility Provider). On the other side, internal unforecastable events at stakeholders impacted the process of negotiation accomplishment with no leverage by Consortium Partners, as stated by the responsible of negotiations at Utility Provider: ”*Oil company X has just finished its capital restructuration last week; I will meet its CEO next week, but nothing will be signed before September anyway.*” A push for action on installation before contract signature emerged by some partners, concerned by the time-plan increasing delay.

OEMs became aware of the relevance of internal information on technical solutions for charging and communication standards between cars and stations to be shared with other OEMs, not seen as pure competitors, but as participants of a community acting for EV adoption scaling up. At this stage, the configuration of value chain in terms of new participants and role was rendered through visual tools, as shown below:

Figure 42 EV charging value chain dynamics and actors positioning





Source: (Maniak and Marcocchia, 2015)

The visualization of platform dynamics ignited the discussion on the evolution of value collection among participants, and partners became more aware that profitability of the project relies on the ability to collaboratively involve partners beyond the consortium.

As the concern on early adopters' group size and customer acceptance increases for all partners, while approaching the second half of the project Service provider changed its attitude and started asking consortium partners' advices on how to raise customers' awareness on the service availability. OEMs knowledge from previous experience was shared with other consortium members.

Besides, the opportunity of participating to a future European funded project on another geographical area arose and partners expressed their interest in participating.

During the project development, the consortium interacted with European Commission, which main requests on project report concerned the time plan and expense report. The feed-back from and the interaction with other European similar projects was shared among consortium partners, as information source on which factors to consider for a successful project completion.

4.2.4 The epiphany of first users' feedback: September 2015- end of project

Joint actions on customers' awareness and service experience were taken, while EC confirmed the priority of profitability target. First feedback from users had the effect of urging partners to introduce modifications in price scheme and operational flow had to implement in order to comply with EC expectation. Information on modifications to be taken was informally and partially discussed, while partners discovered a learning-by-doing process and started to share consideration of other revenue stream collectable from the infrastructure.
Nevertheless, as information on economic feature of the service was hardly available, the definition of the value network, and consequently, the business model of the project, was a difficult exercise to push forward. The discussions on the stakeholders' interactions were possible at a qualitative level, but with very few information on quantitative data related to the service characteristics and economic mechanisms behind it. As part of the business model assessment, the modelization of a business plan driven by traditional revenue generation rules was presented, with no satisfactory result in terms of sustainability of the project in the short or medium term.

Figure 43 Business plan modelization for Capex sharing exploration

Tri-standard QC	
CAPEX	
Chargeur	15 000 €
Installation	25 000 €
Connexion réseau	5 000 €
OPEX	
Maintenance	1 000 €
Supervision	600 €
Abonnement electrique	1 000 €

- Même subventionné, l'investissement dans un réseau de recharge n'est pas rentable en faisant porter la charge au client (Corridor Breakeven : @5€ : 5 recharges par jour).

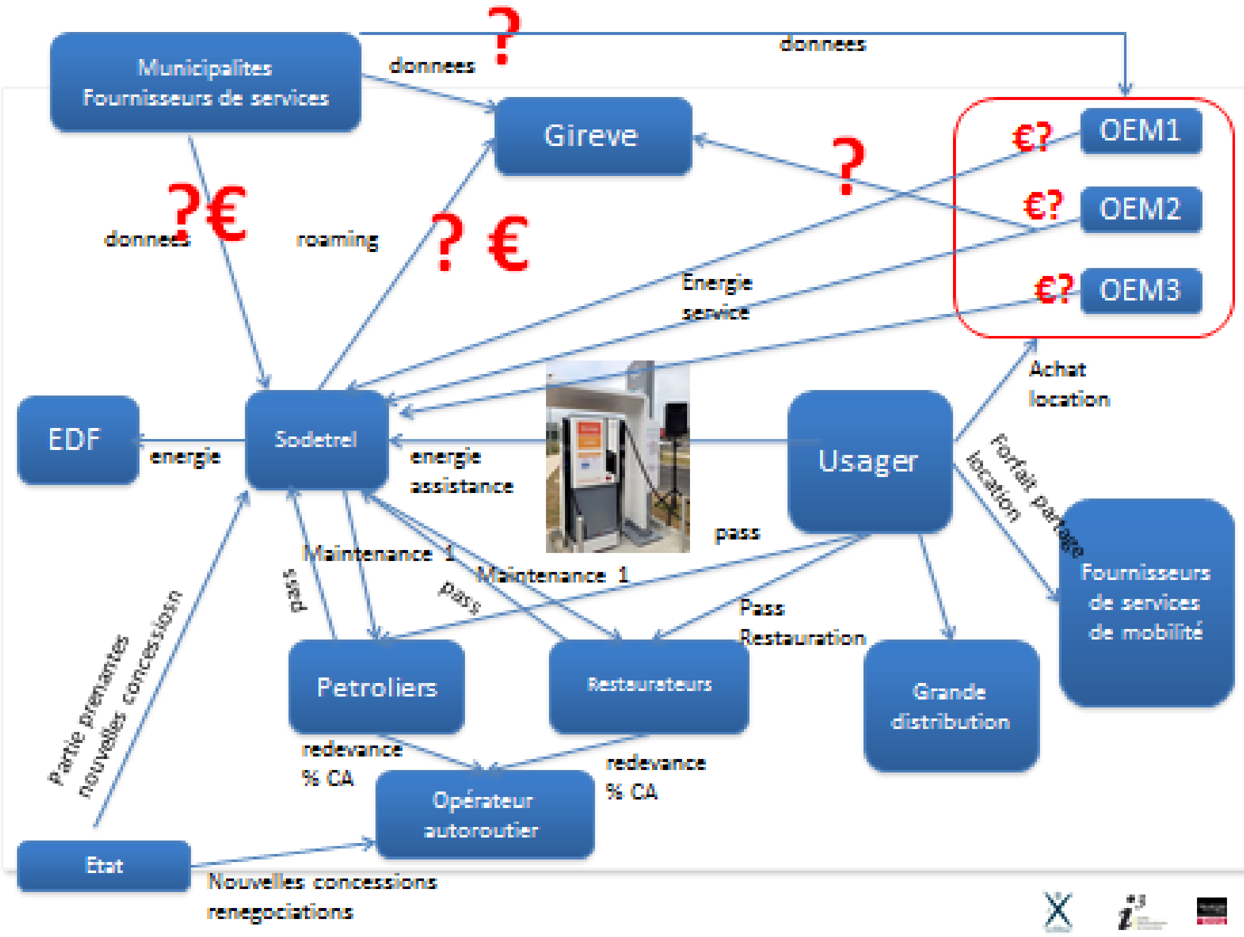
NB / Prix	- €	1,00 €	2,00 €	3,00 €	4,00 €	5,00 €	5,00 €	7,00 €	8,00 €	9,00 €	10,00 €
0	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €	- 11 109 278,94 €
1	- 11 109 278,94 €	- 10 616 283,58 €	- 10 123 288,22 €	- 9 630 292,87 €	- 9 137 297,51 €	- 8 644 302,15 €	- 8 644 302,15 €	- 7 658 311,44 €	- 7 165 316,08 €	- 6 672 320,73 €	- 6 179 325,37 €
2	- 11 109 278,94 €	- 10 123 288,22 €	- 9 137 297,51 €	- 8 151 306,79 €	- 7 165 316,08 €	- 6 179 325,37 €	- 6 179 325,37 €	- 4 207 343,94 €	- 3 221 353,22 €	- 2 235 362,51 €	- 1 249 371,80 €
3	- 11 109 278,94 €	- 9 630 292,87 €	- 8 151 306,79 €	- 6 672 320,72 €	- 5 193 334,65 €	- 3 714 348,58 €	- 3 714 348,58 €	- 756 376,44 €	722 609,63 €	2 201 595,70 €	3 680 581,78 €
4	- 11 109 278,94 €	- 9 137 297,51 €	- 7 165 316,08 €	- 5 193 334,65 €	- 3 221 353,22 €	- 1 249 371,80 €	- 1 249 371,80 €	2 694 591,06 €	4 666 572,49 €	6 638 553,92 €	8 610 535,35 €
5	- 11 109 278,94 €	- 8 644 302,15 €	- 6 179 325,37 €	- 3 714 348,58 €	- 1 249 371,80 €	1 215 604,99 €	1 215 604,99 €	6 145 558,56 €	8 610 535,35 €	11 075 512,13 €	13 540 488,92 €
6	- 11 109 278,94 €	- 8 151 306,79 €	- 5 193 334,65 €	- 2 235 362,51 €	722 609,63 €	3 680 581,78 €	3 680 581,78 €	9 596 526,06 €	12 554 498,20 €	15 512 470,35 €	18 470 442,49 €
7	- 11 109 278,94 €	- 7 658 311,44 €	- 4 207 343,94 €	- 756 376,44 €	2 694 591,06 €	6 145 558,56 €	6 145 558,56 €	13 047 493,56 €	16 498 461,06 €	19 949 428,56 €	23 400 396,06 €
8	- 11 109 278,94 €	- 7 165 316,08 €	- 3 221 353,22 €	722 609,63 €	4 666 572,49 €	8 610 535,35 €	8 610 535,35 €	16 498 461,06 €	20 442 423,92 €	24 386 386,77 €	28 330 349,63 €
9	- 11 109 278,94 €	- 6 672 320,72 €	- 2 235 362,51 €	2 201 595,70 €	6 638 553,92 €	11 075 512,13 €	11 075 512,13 €	19 949 428,56 €	24 386 386,77 €	28 823 344,99 €	33 260 303,20 €

VAN Corridor à 8 ans en fonction du prix et du nb de recharges quotidiennes (200 véhicules, CMPC = 8%)

Source: (Maniak and Marcocchia, 2015)

Researchers' use of value assessing tools was instrumental in keeping the debate open on investment and cost sharing logics, as well as on the roles played by private and public partners.

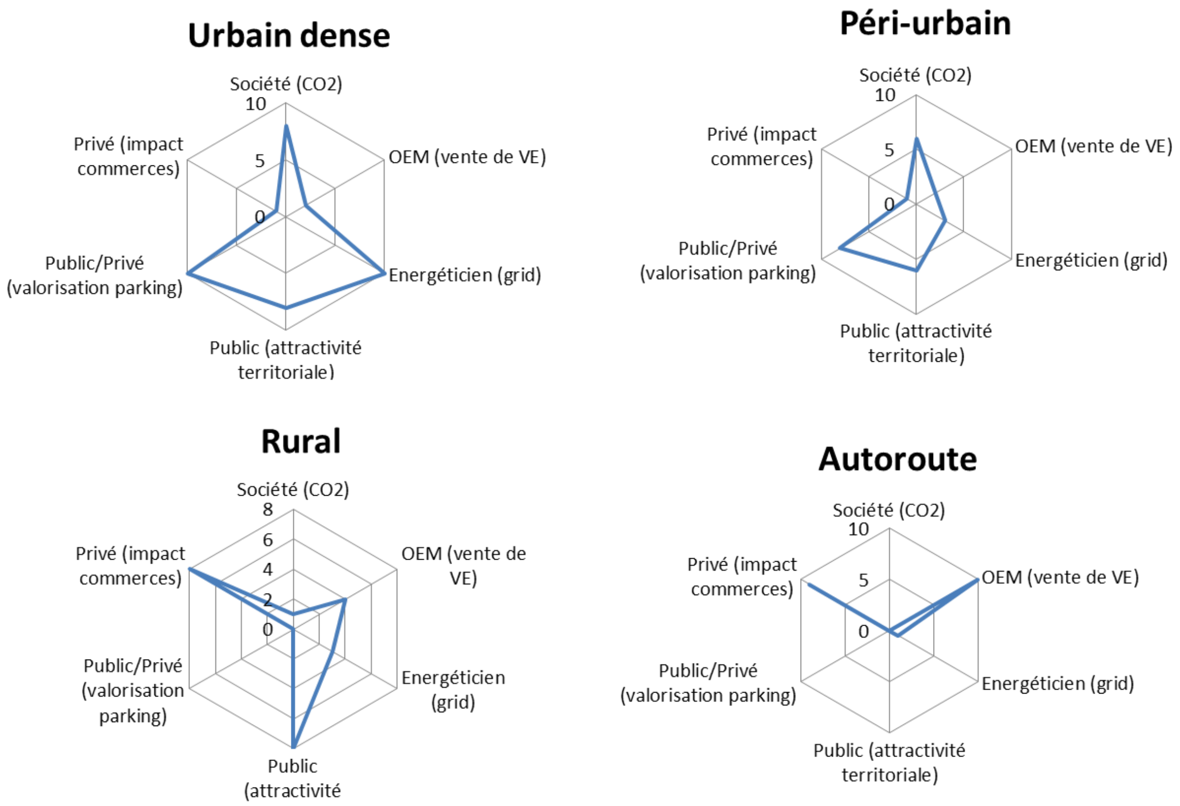
Figure 44 CorriDoor Value Network exploration



Source: (Maniak and Marcocchia, 2015)

As far as the granularity of the business model was concerned, the progressive discover of the relevance of local characteristics drove the definition of different levels of networks to be considered as far as value proposition for users and value generation for partners.

Figure 45 Value generated by station depending on the location



Source: (Maniak and Marcocchia, 2015)

The role played by the project on e-mobility adoption was then stated, as a catalyst of the ecosystem expanding, involving new comers that become strategic players (oil companies, local site managers, interest communities).

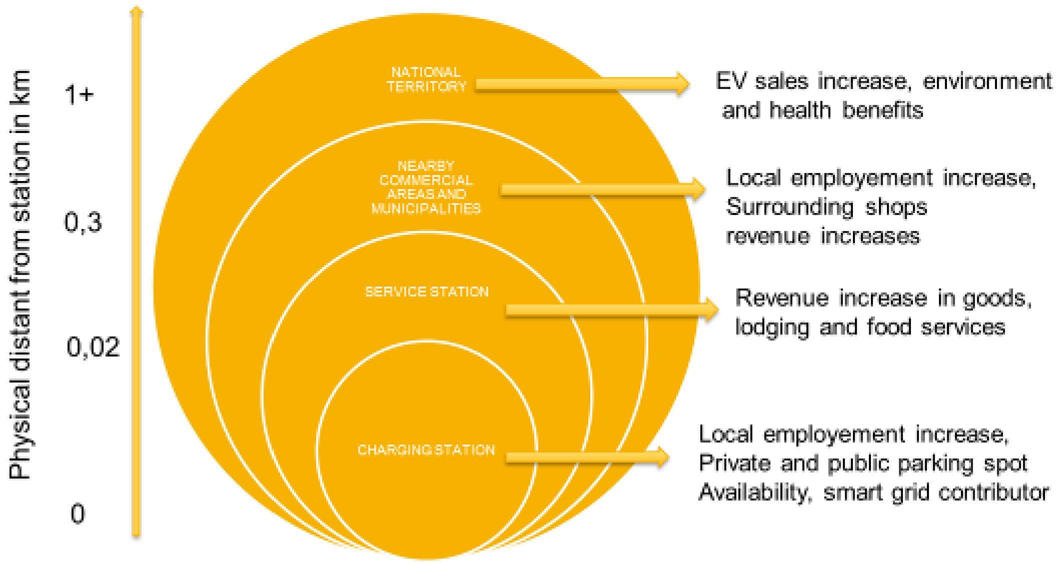
No clear shared vision on platform leadership was present at that time, but leadership focus appeared to be «diluted», as value and investment sharing are so complex and investment high compared to available incentives, and geographical interest on the project was not even among partners. OEMs started to involve European management into project actions, as their interest was clearly on a supranational availability of the service in order to push EV adoption for each brand. "*Our European headquarters wants to be involved in the call with the Oil company and Utility provider for these two stations. We want to participate to the discussion in order to separate price from general agreement discussion.*"(E Mobility General Manager, OEM).

While the project was in the rush to the maximization of stations installation, another un-forecasted event perturbed the timeline completion. Paris terrorist attack generated disruption for the Utility Provider, with consequences on installation completion.

Furthermore, a new typology of stakeholder (supermarkets) revealed to be more difficult to handle in terms of local site negotiation than forecasted, and such obstacle ignited further collaborative initiatives among partners:" *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.*)*

Based on the above elements and on the analysis of the stakeholders' interviews performed, the geographical location of each infrastructure site (charging station) appears to heavily impact the value creation and collection at different levels depending on the actors considered. Following the above analysis, the value footprint per station and per actors based on the distance from the station, was then designed.

Figure 46 Charging station value footprint



Source:(Maniak and Marcocchia, 2015)

The locations of charging stations were then characterized by the environment within which the service is deployed. Four categories were identified: Urban dense, Peri-urban, Highways and Rural.

The second step has been the definition of the different typologies of value generated for the actors contributing to the ecosystem definition. Two main typologies of value have been considered:

- Direct value: short term revenue generation of the fast charging network
- Strategic value: medium- long term sustainable future revenue generation, future activity differentiation and deployment of product or services.

Then a matrix was created to assess the value each actor participating to the service deployment might collect from each typology of infrastructure location, with a preliminary color-based indication of value qualitative degree. Below we present an extract of the matrix:

Table 11Extract of Value mapping matrix

ACTOR	URBAN DENSE		PERI-URBAN		HIGHWAYS		RURAL	
	Direct value	Strategic value	Direct value	Strategic value	Direct value	Strategic value	Direct value	Strategic value
Carmakers	Low EV volumes sales increase	Increase the competence in services related to new technology, increase competence in the connected car ecosystem	Low EV volumes increase to private owners,	Increase the competence in services related to new technology, increase competence in the connected car ecosystem	EV volumes increase, fossil fuel powered cars sales authorizatio n mantained	Increase the competence in services related to new technology, increase competence in broad alliances and cooperation with actors of same sectors or other sectors, increase competence in the connected car ecosystem	EV volumes increase, fossil fuel powered cars sales authorization mantained	Increase the competence in services related to new technology, increase competence in broad alliances and cooperation with actors of same sectors or other sectors, increase competence in the connected car ecosystem

Source: (Maniak and Marcocchia, 2015)

By the application of such a tool, consortium participants became aware of the whole value the infrastructure might represent for them in different time horizons, and they had a more comprehensive understanding of the business perspective for strategic decision making on current project and related ones. Besides, the value mapping assessed allowed the consideration of a broader set of partners for future expansion of the project activity as potential investors, as an element for the CAPEX/OPEX problem solving trough extended participation to the initial phase of the innovation project.

A hybrid form of business model was then identified as relevant to such interoperable infrastructures deployment project:

Table 12 Business model typologies

	Public Business Model	Private Business Model	Hybrid Business Model
Examples	ESB (Ireland), Mobi-E (Portugal), E-laad (NL), Amsterdam, Elmo (Estonia). Cities. Japan , Oslo and Norway. China		
CAPEX/OPEX Sharing	100% public (Europe, State, Region, City,)	100% private: carmaker, mall, restaurant, hotel, private people, privately owned local utility providers	CAPEX shared between Europe or National authorities and private partners OPEX is expected to be covered by the value generated.
Value creation & sharing	Social spillovers, environmental issues, local attractivity for cities, avoid capital urban concentration for rural networks	Value relies on EV selling for private people and externalities captured by one private actor (customer capture, upselling)	**Mix between social benefits and private externalities?**

Source: (Maniak and Marcocchia, 2015)

Such tools clarified the role of private and public partners in allowing the projects to become profitable, and in sustaining the role of public actors as un-replaceable ignitor of collaborative projects on mobility infrastructure.

Consortium officially declared to EC the project had an estimated delay of one year, and that it would have committed to the completion even with no further funding from EU for the extra-time, because they became aware of the strategic value of a denser network for service adoption on one side, and EV sales on the other.

Although OEMs and service provider resisted opening communication on sensitive information since the beginning of the project, a certain degree of cooperation was achieved. Some of the partners became openly aware and open to the acceptance of a new role and partner dynamics in such projects, such as co-innovator partnership. The progressive discovery of additional costs in terms of time and installation determined a final acknowledgment of further actions to be taken toward platform dynamics ignition. The accurate composition and dynamics of Capex and Opex were fully revealed, as the urgency to collaboratively working on Capex reduction and Opex financing ("*We cannot transfer the full cost of installation and operation of stations to the final users, otherwise price will always be too high and he won't subscribe to the service. We need to work on smart joint strategy for Capex reduction* » EV Business Development Director OEM; "*Financing the Opex is a key problem to be solved*" E mobility Director OEM). As a result from the project, the Capex financing was in a very little proportion shared by some stakeholders external to consortium and not previously considered as potential participants to the investment, but detailed information on it were not disclosed by Service Provider. As far as the Opex, and the repercussion on service final price, the lack of transparency on Service Provider strategy drove toward incoherent price scheme proposals to final users, as prices for the same infrastructure were different depending on the platform allowing the access to it. A basic problem of revenue sharing for the service emerged. The pure financial logic applied by Service provider in pricing appeared counterproductive to OEMs and drove to a new round of talks, bilateral talks between OEMs and Service Provider ("*B2B2C negotiations are possible, we are asking ourselves how we can make our customers pay the full price. OEMs should probably participate to the fixed part of subscription demanded by Service Provider, in order to equalize communication on prices »* EV Business Development Director.)

As far as value from the project, OEMs initial vision of the project as EV sales booster evolved toward a more collaborative vision on how to reach the desired adoption effect, with arising awareness on the current impact of the project in their strategic roadmap. As stated by an OEM:" *We want to integrate CorriDoor in our advantage package for our customers, as it is an enormous selling point for EVs."* And by another:" *We have one SME customer waiting for CorriDoor to be completed before re-signing the lease of their fleet with us! We need the project done!"*

Nevertheless, the lack of service design approach and of transparency of exchange from Service Provider, resulted in awkward still missing shared definition on service features at the end of the project, such as: « *It is not clear if there is a penalty for the user who won't free the charging spot after having charged and unplugged the cable. We only have one charging car at the time!*" Electro-mobility Manager, OEM).

Consortium partners were convinced that service adoption was uniquely based on customers' willingness to pay, and all the budget on infrastructure design was dedicated to technical features, with few money left to invest on customer experience design (which is key on early stage of disruptive innovations) (Moore, 1995). Partners with direct contact and knowledge on car users and partners with the responsibility of conceiving the service didn't shared reciprocal knowledge. Some basic features of the service were missing, as for the proper signaling of the station at the entrance of the area. Such defaults resulted in a non-seamless experience for users, and in bad comments on Service Provider websites, and related blogs. The missing target on user experience satisfaction was then comforting the Consortium in not focusing on it.

Figure 47 First station commercialized by the Consortium

Source: picture by Marcocchia 2015

The credibility OEMs initially associated to the Service Provider was questioned after the feedback from customers, as it appeared that the service features, from station design, to user experience for the digital platform were not fully compliant with users' expectations.

We also noted an evolution also on the utility provider side, from whom the project at the end was seen as *"a marketing site to work on together*" (Negotiation Manager, Utility Provider), and as a link to other European projects potentially relevant for infrastructure extension ("*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).

As far as technical and commercial knowledge, the complexity of activities flow, from first visit for technical assessment to charging station commercialization, resulted into internal processes creation by some participants. As stated by the Utility Provider: « *We introduced two internal processes to accelerate the certificate achievement from three weeks to one week delay. We have just been able to identify this knowledge improvement now, during the deployment process*."

As far as negotiations with location managers, the role of OEMs evolved up to being partially negotiators along with the service provider. From Service Provider's demand, to location managers request (i.e. supermarkets), the improvement of operations in certain areas was achievable through the direct involvement of OEMs. As a result of this role and of the technical functioning of the stations, new relationships take shape for location managers and OEMs local dealers for user adoption increase.

The overall delay in project delivery has several impacts on Consortium partners. The main issue was the identified in several un-forecasted actions to be taken in order to move the project forward, as the link between the connected station and the authorization of selling the service ("Process is complex as there are things to be done on parallel…. » Utility provider program manager.

In terms of resources, as the commercialization of the total quantity of stations had to be completed, partners were requested to keep working on the project after project ends and with no additional funding from the EC.

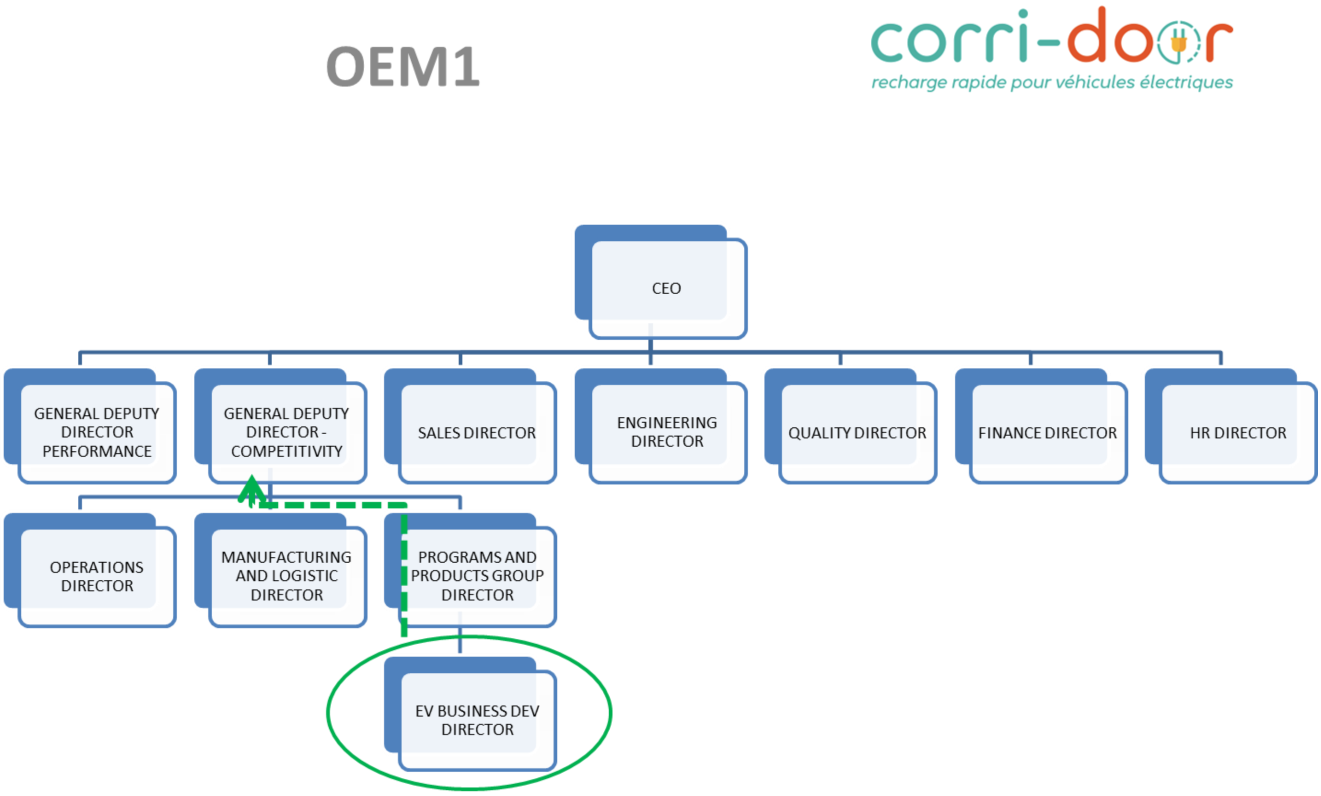
In terms of sales and image, the delayed availability of the service resulted in reduced sales on service for the Service Provider and vehicles selling or leasing for OEMs ("*The delivery of the infrastructure beyond December 2015 is hard to manage in terms of image. We already announced dealers that the service would have been available in May, then September, and now next year*!" OEM EV manager).

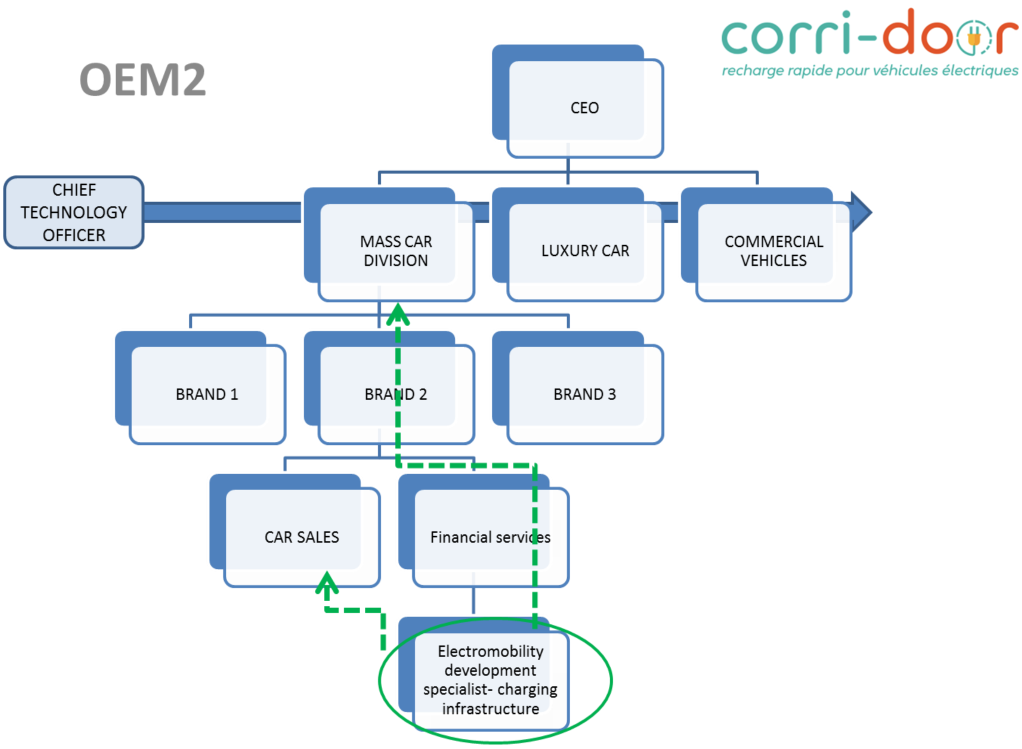
As far as the final goal of the project, the installation and commercialization of the totality of the charging stations (200), it was then completed at the end of 2016, a year later compared to the proposed and funded plan. EC allowed partners to keep working together in an extended legal frame although no additional budget was provided for the extra time and extra resources needed. The Fact that the French CorriDoor was in link to similar and networked initiatives in neighboring countries allowed a minimum of flexibility on project management from EC.

As a value created from the project, we observed that Consortium partners benefited at different levels of the knowledge created in terms of infrastructure design and deployment, and the know-how accumulated related to the strategic partnership needed toward deployment success.

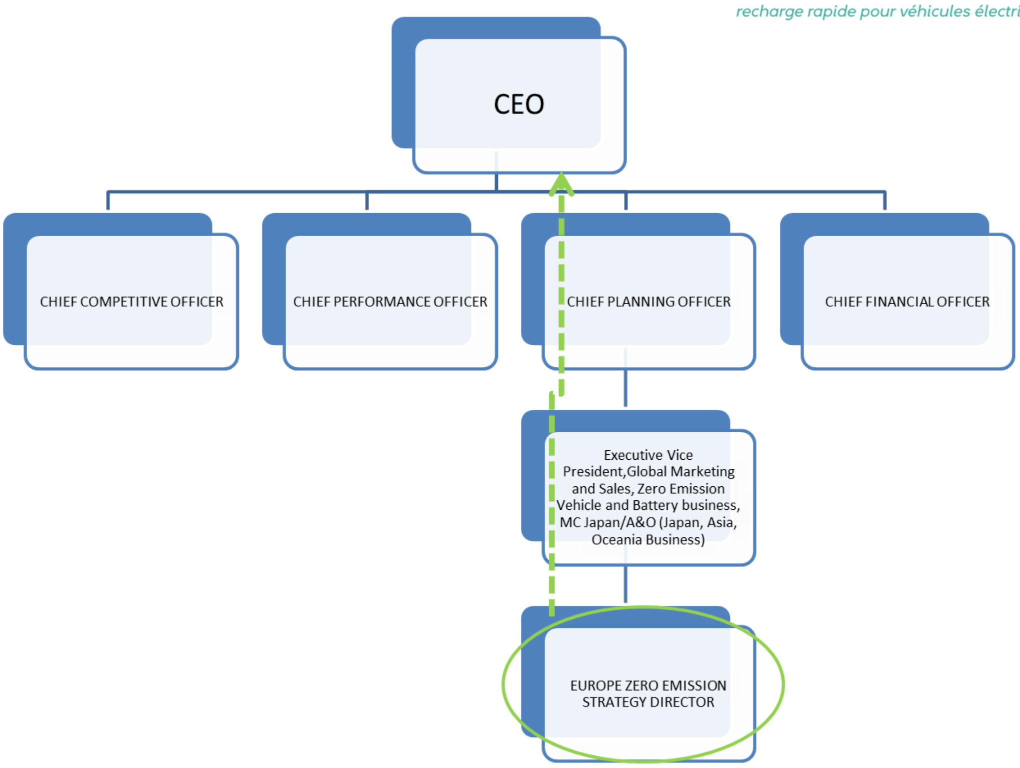
In terms of internal dynamics, Consortium participants were able to raise the awareness on project value to the high level of firm's hierarchy, as shown in the figures below:

Figure 48 Project visibility impact on partners' organization

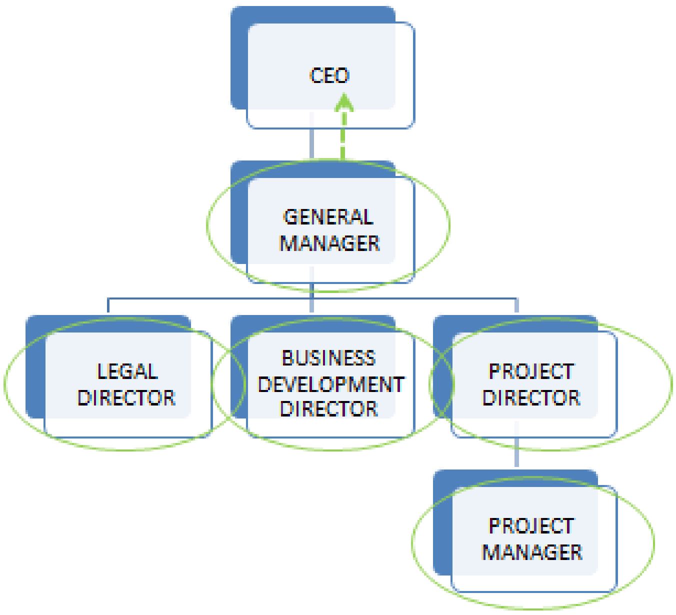


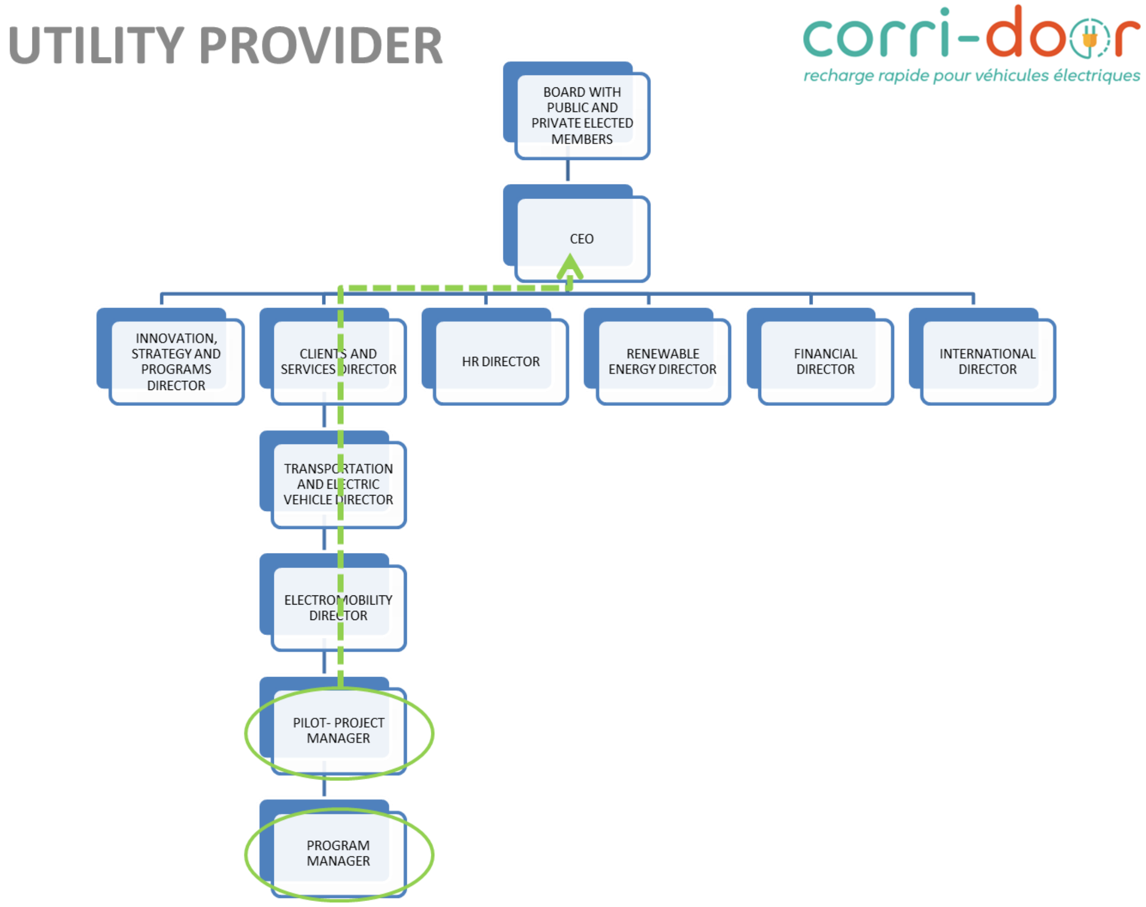


OEM3



SERVICE PROVIDER





Following the experience acquired with CorriDoor, and based on the relationship and alignment built, some actors took the strategic decision to embark on a second project, called CorriDoor 2 Unit-E. CorriDoor Utility provider, Service provider, and OEMs with declared internal focus on EV adoption as strategic priority, they unite intent and resources as a new team in order to develop a proposal of EV fast charging infrastructure deployment complementary to the one deployed through CorriDoor, and always based on the big frame of European network of fast EV charging infrastructure.

The Consortium of the second project included a charging station manufacturer and a location owner as well as facility manager and public space developer.

4.2 Automat- The European car data Marketplace

The case shows how various players align in order to build a prototype of a car data marketplace, which should lead to car connectivity value capturing and distribution performed for the benefit of European citizens.

Mobility actors have in their strategic roadmap the consideration of how the value generated by vehicles' connectivity can be captured and distributed. Digital data-exchange based platforms flourish with the promise of enabling the concretization of the value generation among users groups which are trying to increase the value of the data stream. But concretely, data marketplace with successful multisided dynamics and scalability performance are not the ones facing high level of data aggregation and normalization among different suppliers. Exchanges based on data valuable only if packaged among several actors are far from being stabilized in terms of offer demand matching among platform users and marketplace managers are hardly finding their profitability. Besides, car data are submitted to the threat of personal data protection, which is rising in companies' concern not only for the ownership of the data, but also for the cybersecurity protection and the use that owners and national authorities will allow on data itself. As for every emerging field, regulations are defined along with the data use experience move forward with the misuse of personal data and cases of cybersecurity failures.

In this exploratory field of car data exploitation, we can detect not only a standard chicken&egg economic dilemma, but wider and more complex difficulties in solving the profitability equation of the marketplace. The challenge of data marketplace design and management faces technical, business, legal and social issues. Initiatives from private actors as Otonomo started to emerge since 2015, but with high level of investment for testing and no proven results in terms of platform adoption and commercialization. The rising interest of GAFA in terms of autonomous vehicles and overall personal data capturing, alerted incumbents in automotive industries and international authorities on the need of taking initiatives toward data protection and use regarding to future mobility services. As stated by FCA CEO in 2016, *"Walking with intruders (i.e. Google for AV) is the best possible solution for us in terms of determining what our future state will be"* (Marchionne on Autonomous Driving Test on Pacifica in partnership with Google May 6th 2016).

In 2014 EU decided to take action and approved a research project in the aim of fostering a collaborative action among different groups of complementors and users for a marketplace prototype creation. It seemed the perfect tool at the right moment for OEMs, IT specialist and service providers to initiate the dialogue.

The consortium was composed by three automotive manufacturers, one utility provider, two service providers, two privacy IT and cloud operators, three management and academic institutions. The goal set by the consortium was to develop a prototype of profitable marketplace for the exploitation of data collected from cars, for new services creation in automotive-related field and in cross-sectorial applications. The project started in April 2015 and ended in April 2018.

Consortium partners had different expectations and paths during the project development and got different take away at project end, but a common result of setting a step toward the chicken&egg

problem resolution was achieved.

4.3.1 Initial settings

Three OEMs, originally from three different European countries, but all globally present for manufacturing and selling and or leasing cars, are all experiencing the urgency of monetize the treasury of data that seems to be so easily accessible in other sectors. CEOs are setting strategic paths for actions to be deployed at management level, and new partnerships are explored. Budgets are allowed at different departments for short term actions to demonstrate the data treasure exists and it is at company's reach.

The will and ambition of strategic action on connected vehicle is declared at the high level of the hierarchy, but "*the operational results are not coherent with it* » (R&D Manager, OEM). The need of further investment for pushing the innovation exploration forward is perceived as the need of a wider scope of data use than maintenance in order to make business sense of it. Internal initiatives do not deliver the result in terms of multi-side convergence needed by such platform establishment and scalability. Certain external funded initiatives appear to have the right setting (structured and pre-defined time-plan, participants list and action framing, ecosystem interactions, deliverables) to be formally accepted by the company culture and processes and they represent a framed approach to collaboration among competitors and unknown partners.

As far as the service offer is concerned, the relevance of digitally enabled collect and value extraction from data become the fuel of service quality upgrade and new business development for Service Providers. They become eager to ingest data, to improve and create new algorithm, but data per se do not have value if they are not usable. And firstly collected new data hadn't given proof of usability yet. One-to-one talks among service providers and incumbents hadn't provided any appreciable result in the field of large automotive big data yet.

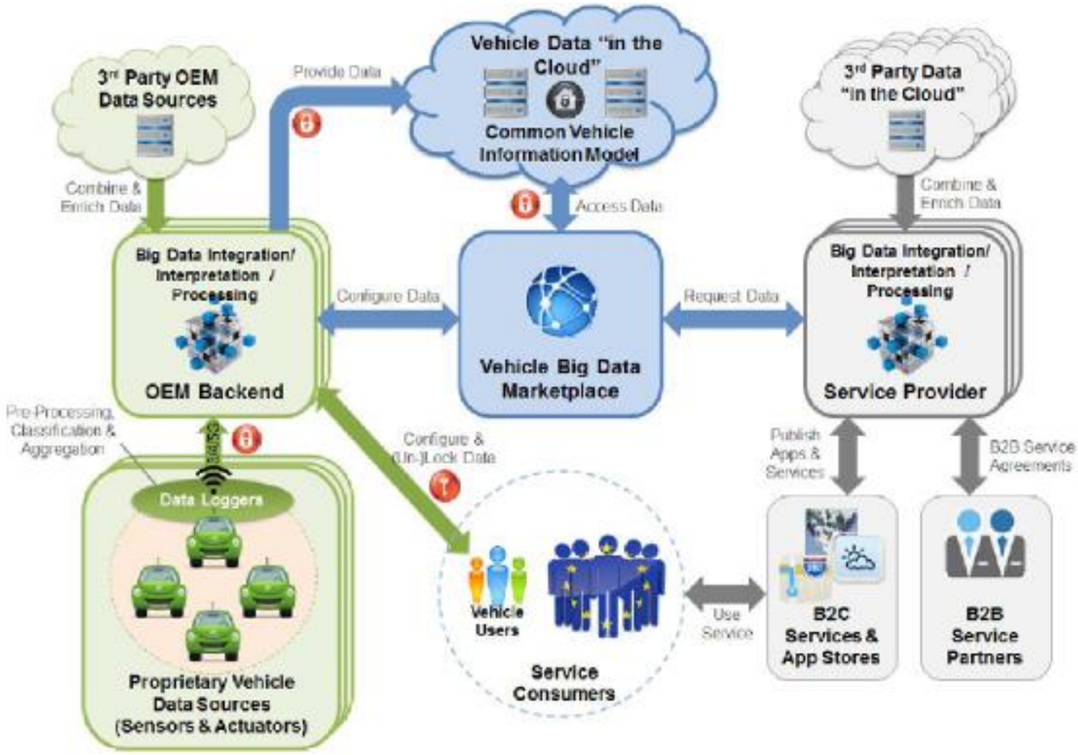
As far as the IT service companies, providing also data center management and digital transformation, the digital networking of sectors and business represents an evolution of the competition battle-field of their activities define their positioning into a complex value network in which they might play the enabler.

The relevance of the abuse of private data and the consequences of failure in protecting data flow are positioning the companies giving consultancy in such area in a permanently-evolving path of assessing and recommendation formulation, but constantly in need of searching

Based on the above, actors complemented internal initiatives with an externally funded and formally framed project of research for a data marketplace, in the aim of solving their difficulties in facing the car data treasury hunting challenge.

During project proposal, the future development of actions was designed in a flow chart as per the figure below:

Figure 49 Automat Ecosystem designed for project proposal



Source: (European Commission, 2014)

The time-plan in order to develop the marketplace at the core of the ecosystem was strictly bounded in the accepted proposal, and detailed in terms of use of resources and deliverables description and completion, as shown in the figure below:

Table 13 Automat Ecosystem designed for project proposal

WP Nr. Work Package Name	VW	Renault	CRF	ATB	ERPC	TUDO	ATOS	METEO	IMT	Trialog	HERE	Total per WP
Partner No.:	1	2	3	4	5	6	7	8	9	10	11	
WP 100 Operational Project Governance	26,0	2,0	2,0	15,0	17,0	7,0	12,0	2,0	2,0	2,0	2,0	89,0
T 110 Operational Coordination	10,0			4,0	7,0							21,0
T 120 Financial Coordination	6,0			6,0								12,0
T 130 Scientific Coordination	6,0			3,0	8,0							19,0
T 140 Dissemination, Exploitation & Communication	2,0	2,0	2,0	2,0	2,0	7,0	12,0	2,0	2,0	2,0	2,0	37,0
WP 200 System Design & Big Data Concept Transfer	14,0	8,0	6,0	8,0	5,0	6,0	6,0	6,0	8,0	5,0	4,0	76,0
T 210 System and Service Requirements	5,0	5,0	3,0	3,0		3,0	3,0	3,0	3,0		2,0	30,0
T 220 Overall Innovation & Technology Transfer Concept	9,0	3,0	3,0	5,0		3,0	3,0	3,0	3,0		2,0	34,0
T 230 Cyber Security Concept & Framework					5,0				2,0	5,0		12,0
WP 300 Vehicle & OEM Data Products & Services	43,0	22,0	29,0	18,0	0,0	16,0	2,0	3,0	0,0	0,0	3,0	137,0
T 310 QoS-adaptive and embeded Data Mining inside the vehicle	16,0	3,0	15,0	7,0		3,0						44,0
T 320 OEM Backend Data Harvesting and analytics	18,0	10,0	10,0	8,0		3,0						51,0
T 330 Common Vehicle Information Model	8,0	9,0	4,0	3,0		10,0	2,0	3,0			3,0	42,0
WP 400 Vehicle Big Data Marketplace & SDK	20,0	8,0	6,0	5,0	0,0	7,0	55,0	4,0	0,0	0,0	4,0	109,0
T 410 Vehicle Big Data Marketplace	15,0	8,0	6,0				48,0	4,0			4,0	85,0
T 420 Software Development Kit (SDK)	5,0			5,0		7,0	7,0					24,0
WP 500 Cross-Sectorial Vehicle Data Services	0,0	0,0	0,0	4,0	0,0	4,0	0,0	29,0	0,0	0,0	21,0	58,0
T 510 Meterological data based Hyper Local Services				4,0				29,0				33,0
T 520 Extended Innovative Enterprise Services						4,0					21,0	25,0
WP 600 Business Impact	18,0	9,0	10,0	8,0	0,0	8,0	12,0	10,0	15,0	0,0	9,0	99,0
T 610 Cross Sectorial Vehicle Data Service Demonstration	10,0	6,0	7,0	2,0		5,0	9,0	8,0			7,0	54,0
T 620 Open Service Contest	5,0	1,0	1,0	6,0		3,0						16,0
T 630 Business Model Value Chain	3,0	2,0	2,0				3,0	2,0	15,0		2,0	29,0
	121,0	49,0	53,0	59,0	22,0	46,0	87,0	54,0	25,0	7,0	43,0	566,0

Source: (European Commission, 2014)

4.3.2 Marketplace technical features: not an easy add-by-add process, but a shared decision-making process: April 2015- October 2015

For involved partners, the declared interest in the project was initially linked to direct sales increase of current products and services.

At project kick-off, actors' positions showed the different level of expectations compared to project ambition. Some incumbents openly exposed some reluctance in the possibility of getting some results on the business case dilemma of such marketplace ("*We tried everything already and no business model worked. There is no business model for such platform*" Telemetry services manager, OEM). The role of reinforce the ambition and the impact target of the project was mainly played by the EC commissioner, the researchers and Service Providers, whom participation to the project was driven by the opportunity to explore new solutions to unsolved problems.

Data format and packages initially proposed by OEMs were debated during months among partners in the aim of format coherence consensus reaching and use cases applicability. Several workshops of partners' sub-groups were introduced as effort of alignment on vision toward key features of the marketplace, including standardization, data privacy and cybersecurity.

The utility of the car as data collection sensors is initially seen as value generator by the simultaneous collection of data available separately and not linked for a seamless use by service providers.

From preliminary demand description from consortium service providers, it appears that the challenge on define the marketplace offer was not on the technical side of collecting data, but more on the critical sizing of the collection and on how to aggregate data. To create and to sell data packages are the critical issues to be solved at first.

Discussions on data structure shown data categorization was initially set as very engineering & automotive oriented with no fit to potential customers and users.

Investigations were conducted by the researchers in order to assess the business potential of the Automat concept, and the required conditions to generate, relying on this experimentation, a sustainable business model. The feedback from a large panel of interviews resulted in a confirmation of interest for getting data collecting from cars, but it confirmed the persistence of the chicken&egg problem between offer and demand, as shown by a selection of the statements collected and reported below:

"I think an highway operator and a carmaker could have a real interest to collaborate about data, with a « big data package », so we can show our roads are safe, green,… and to use it as a business input for us"(Sustainable development and environment Responsible, Highway Operator)

"In order to design public « smart cities », we rely on data about people, their habits, flows,…We have data from public transports Ids, smartphones… I think we'll have many things to do with data coming from cars, but we do not know about" (Territories and Development Responsible, Urbanism Consultancy)

"We wish we could collaborate more with OEMs. However we do not know who to speak to" (Innovation Services Responsible, Highway Operator)

"We clearly need information coming from the car. However we need to dig into these data to get a taste of it." (Business Development Manager, Mobility Service Provider)

It clearly emerged that potential service providers and future users need to discover and experience the data packages before formulating a specific and detailed demand. The need of taking into consideration users' needs during the exploration phase was highlighted, in order to steer the prototype definition process. The path toward offer and prototype definition appeared to be inevitably an iterative one, with technical and usability check between data providers and data users. Debate on closed or open platform and on a potentially hybrid public-private business model design for the marketplace was still ongoing and boosted by the above consideration coming from the field in terms of marketplace future adoption.

In September 2015 the need of convergence was perceived by some consortium partners and addressed with dedicated restricted sessions. Data categorization convergence among OEMs was addressed by specific session among them, which result on a vote on a preliminary list of categories. Five categories were identified on the bases of OEMs' measurement wishes in a top down approach, as: vehicle, driver and passengers, environment, mobility and navigation, connectivity.

Partners decided not to freeze the list, as new categories could have been found during the process,

and that the exploration of such category will be led by one consortium partner.
At the same time, privacy and cybersecurity agencies aligned their vision on they had to perform for cyber security concept and standardization.
Service providers started expressing initial hypothesis of use and declared which data would have been of their interest ”*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). Simultaneously, business and use case on service providers' side were not defined at a satisfactory level for actors on the offer side, demand, and for privacy assessment agency, who expressed the need "*to have as soon as possible a clear view on use cases for privacy cases study protection and data ownership"* (Director, Privacy assessment agency).
Some partners realized that the challenge of the project on this subject could have been beyond the compliance with existing regulation, up to the influence in the future legislation definition for other highly systemic and disruptive projects (i.e. the autonomous driving). In particular, the dialogue among Service Providers and Privacy Agency pointed out existing obstacles to legislation update and intentions of solving such impediments, as stated by the Director of the Privacy Agency: *"The European court of justice is moving toward fighting use of data by Google and FaceBook, but not fast enough. We want to talk to people at OEMs in charge of legal department and working on the autonomous cars."* Other partners warned for the potential negative impact of involving legal departments, which can delay the solution findings. The isolation of some individuals among their own organizations emerged, as well from the difficulties in starting car data collection campaigns.
At the same time, the data package catalogue specific to the project, the Common Vehicle Information Model was explored in its Key functionalities and requirements, such us brand independence, configurability, scalability, specifications and definition of rules, development of application programming interfaces, and process definition for update management of the Common Vehicle Information Model (CVIM) itself.
While debating on CVIM requirements, an issue on word interpretation arose. Anonymization of data and platform scalability were at stake. A word initially adopted by partners as the main feature of the marketplace, appeared to have meanings for each partner. Another word generating divergence in meaning association was the scalability of users, or in terms of number of vehicle or in terms of storable data. Service providers expressed the wish of separating marketplace scalability from cars manufacturing. Lack of precision on data collection protocols from OEMs made more difficult the demand formulation on Service providers' side.
The overall approach to the project business model was based on business plan definition for the direct sale of data from the marketplace, without discussion on value proposition for users. From

analysis of preliminary features of the marketplace, this frame appeared not to be viable, unless assigning a "safe" high price to the service, endangering the early-adoption dynamics. The degree of platform openness was still an open debate among partners, as clear tangible evaluation of business impact and risks linked to such choice was not available. 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).

4.3.3 Defining-by-doing acceptance: November 2015-August 2016

As far as offer side, first results on external potential users investigation and the on-going dialogue among partners on data package definition led to the general consensus on the fact that "*the world cannot be defined at the beginning of the project"* (OEM). On data package format and use cases, partners embraced the iterative process of definition between offer and demand. Some OEMs started to provide some data to service providers to start exploring use of them, but there is still no requirement definition from service providers.

The business plan exercise was slowed by the pricing building mechanisms. Partners were divided between a commercial performance of the project, searching the commercial viability of the marketplace, and a more exploratory performance. The role of the project was perceived as a means to become a supplier of a dominant platform dedicated to a bunch of data from different sectors to a specific market target *("the goal of the packages resulting from the brainstorming is to feed Californian developers"* OEM). Besides, service providers shared with the consortium an evolved vision of certain marketplace features for inciting interactions of platform participants. Data collection requirements were defined by service providers, which allowed the test demonstration activity to be developed. As the project moved through first deliverables deadlines, the need of more informal interaction among partners besides the official meetings of the consortium was specified by some partners, but it was seldom implemented. Some partners started questioning the effectiveness of the formal and rigid timeline of the project, formulating different hypothesis of masterplan interpretation and meeting use ("*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?"* Business Development Director, Service Provider).

A wide exploration process revealed that the panel of potential users and complementors was wider than the current partners' focus, which was limited to "*to try to sell services constructed with new data at a higher price to my customers. Not really looking for new areas of business, but increasing the price of my existing services*" Business Development Manager Service Provider. Partners realized that the business model viability and the strategic positioning of the marketplace relies on the ability to collaboratively involve in the dynamic such users and complementors beyond the consortium. Building on such input and on first very preliminary data available from one OEM, a debate on the difference of relevance between signals and phenomenon emerged as a further step into the comprehension of valuable package for service providers. As a very limited quantity of data were available at this time of the project, a service Provider owning sensor-equipped cars proposed to put at project disposal the data collected by its own cars. The association between data and location of capturing is highlighted as value-enhancer.

CVIM further definition is getting done through the iteration of signals evaluations by service providers for phenomena appreciation at marketplace level.

Data repository emerged as a need at each OEM, but also as an area of missing expertise where it was needed. A certain degree of collaboration among partners with complementary know how and expertise occurred.

As far as business model design and assessment, since early 2016 partners refused to provide any quantitative information for flow estimation and an overall confusion on the meaning of business model appeared. Besides, OEMs were asking for very quantitative information on marketplace users, such as: *"We are interested only in having a precise knowledge of the signals the customers wants and how much they will pay for it".* The fact that the project targets a scenario of business viability of a prototype contributes to the difficulty of partners' clear understanding of the project real goal (exploration vs commercialization goals). As stated by one OEM representative: *"The prototype is a quick and dirty object to prove that the marketplace can work, but it doesn't have to be commercial. 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."* But on the same side, frustration on impossibility of price definition for the data package highlighted a schizophrenic attitude on incumbent as the reality of the project and their expectations driven by short term profit logic at headquarter are far from being coherent. The perception of the real goal of the project is also strengthened from the Service Provider perspective*: "business model evaluation shall be qualitative, it has an exploratory aim, no prove of business model profitability will be possible*", in contrast with the EC expectations.

Sessions on business model design were performed in order to incite shared understanding of main concepts and impact of each other decisions on platform performance, aiming at jointly defining among the partners the value proposition and explore the value adding process specific of such marketplace. Partners became aware that users' recognition of data quality and value added to data by the enrichment step is a key phase in value proposition appreciation and consequently in willingness to pay definition. Partners agreed on the project boundaries in terms of data sources for the marketplace (only car-dependent) and they temporarily agreed on shared understanding on concepts such externalities, marketplace business model main features and composition (not one business model, but the hopefully coherent merging of several) and data quality, but internal culture and processes reduced the impact of such agreement. From the open discussions on business model, examples of data enrichment performed by Service Providers emerged, as well as the key role of data aggregation. The strong opposition of incumbents in taking action on data analysis from other sectors drove the consortium decision to the exclusion of such aggregation from the marketplace activity, considerably reducing the value generation potential of it. Some prevalent thoughts on platform dominant position achieving are still driving some actors' approach to the strategic content of marketplace manager role ("*Data aggregation should not be part of the marketplace activity…..Securing raw data access and ownership will prevent google for getting the big chunk of the cake"* Telemetry service manager OEM).

All the above considerations drove the project to a delay in deliverables completion compared to time-plan.

As project development moved forward, two more elements of interaction between marketplace offer generation and the platform users and complementors emerged. As awareness of multisector partnership need arose among OEMs, as per the following statement among others: "*We need to be able to walk this transition, and I think walking in a **collaborative fashion** with people who have historically been viewed as **intruders** and potential enemies of our business"* (Marchionne on Autonomous Driving Test on Pacifica in partnership with Google May 6th 2016). In the project, it is only at mid-term that some partners started to realize the connection between data architecture and intruders for the autonomous vehicle development: "*Every manager knows AV needs a lot of connection and a lot of data. Barriers of the costs of sending data are going down on AV. All managers fear Google, apple, tesla. Managers are not thinking about the cost of connectivity as much as before."* R&D Manager OEM.

As far as the users' need understanding, partners started to show different perceptions of the responsibility of it, and the investment related to it. For incumbents, they should not be paying for understanding the user and customer pain points in order to better define their offer, while for the Service Providers, this activity should be consider as an investment of incumbent, complement to the exploration funded by EC. The project allowed a space to start this discussion on a topic which is still unknown on both side, and to identify that the project of demand-offer matching is potentially longer than expected and won't be covered by Horizon 2020 project funding. The discussion on how to walk the path of price determination ignited the discussion on cost optimization. Firstly approached with no proposal on incumbents' side, the debate moved forward through the input of Service Providers on the role of standards in setting the collection, transfer and preliminary aggregation of data in cost reduction for the resulting package.

While discussing on cost and defining the technical features of the CVIM tool, the consortium realized that another main element was source of misunderstanding among them: the difference between data and information. While the offer side, the incumbents, was considering the result of the CVIM as information toward the marketplace, Service Providers provided a different definition for it: "*information is data in a specific context and the context is provided by the user. The question if we have generated information or not depends on the perspective of the customers. The next person on the value chain needs to consider your delivery as information.*" Business Development Manager, Service Provider.

As the problem of the data collection and management cost was source of debates among partners, the conflicting needs expressed from partners and the European Commission in terms of precision of value estimation needed to find an area of convergence.

We decided to investigate the relationship between value chain step and value creation by associating to each step of the value chain a set of values on a 3-step process:

a) In a first stage we assessed the typology of value created by each step and per each actor in three typologies, and for each value an estimation of degree has been associated. Different degrees were associated to different colors, as it follows:

  - Green: value to be generated from the platform is clearly positive
  - Orange: the value to be generated could be positive, but it is strongly linked to technical/commercial agreements among/with consortium partners
  - Red: value should be theoretically available, but current conditions or characteristics of the platform are preventing the value collection.

The tool proposed was a preliminary matrix showing the value associated to each value chain step and each actor was visualized as follows:

Table 14 Extract of Value chain first assessment on the offer side

PARTIES INVOLVED	TYPOLOGIE OF VALUE	Data generation and acquisition	Data pre-processing and aggregation	Data storage at OEMs Back-end	Data enrichment via OEMs internal knowledge	. Enriched and packaged Data storage in the cloud	Selected data packages put in the marketplace	Contracts management from C and B with OEMS.
Data Generator/owner	Direct value	currently 0, but potential selling of generated data to OEMs	0	0	0	0	0	0
	Indirect value	currently 0, but potential percentage on data sale if data sold by OEMs	0	0	0	0	0	only in case of agreeement of% on OEMs sales
	Strategic value	Potential access to community for enhanced existing services or new services n transportantion related fields or in completely new field	depending on the processing and aggregation, possiblity of access to broader panel of enhanced or new services	0	depending on enrichment, possiblity of access to broader panel of enhanced or news ervices	0	0	depending on the service providers or individual users selling for the enhanced or news ervices to be provided and from which data generator might benefit as user
OEMS	Direct value	0	0	0	0	currently negative for the payment of the cloud service to the service provider	0	guarantee of transaction later
	Indirect value	0	0	0	0	0	0	if contract forecasts percentage of fee for data multiple use with other actors than direct customers.
	Strategic value	high, for data acquisition on car behavior and performances, on car user behavior and profile, to direct and indirect exploitation through strategic partnerships and for capability assets acquisition	high, for capability assets acquisition in data enrichment	high, for capability assets acquisition in data management and consideration of better functionalieies of the backend infrastructure its elf	high, for capability assets acquisition in data enrichment and internal department synergie for value creation	depends on the tasks partition with the cloud manager btw oems back end and cloud. As Automat platform is set, strategic value comes from learning practices with the cloud environment, and exchange of services OEMs and cloud manager might negotatie instead of direct value for data management	more data in the marketplace, more chances to have users interested in buying packages. This value depends also on the openess degree of the platform. The more open, the more strategic value from higher sales and new partnerships.	confirmation of interest in certain packages, and guidance for further products to be put into the marketplace. discosable information on contracts are elements to be used to prove to other potential complementors and other customers that marketplace is a valid platform to join.

Source: (Marcocchia and Maniak, 2016a)

Such assessment allowed the partners to increase the awareness of current and future relevance of the activity they were considering for the project, and it allowed understanding which step could generate more value.

As complement exploratory action in the quest of demand/offer matching, the researcher performed a deep investigation of potential opportunities of pain resolution or new development for marketplace users. Such investigation was conducted within the transportation industry and beyond. Through interviews, the demand segmentation was drafted in a frame, as shown in the table below.

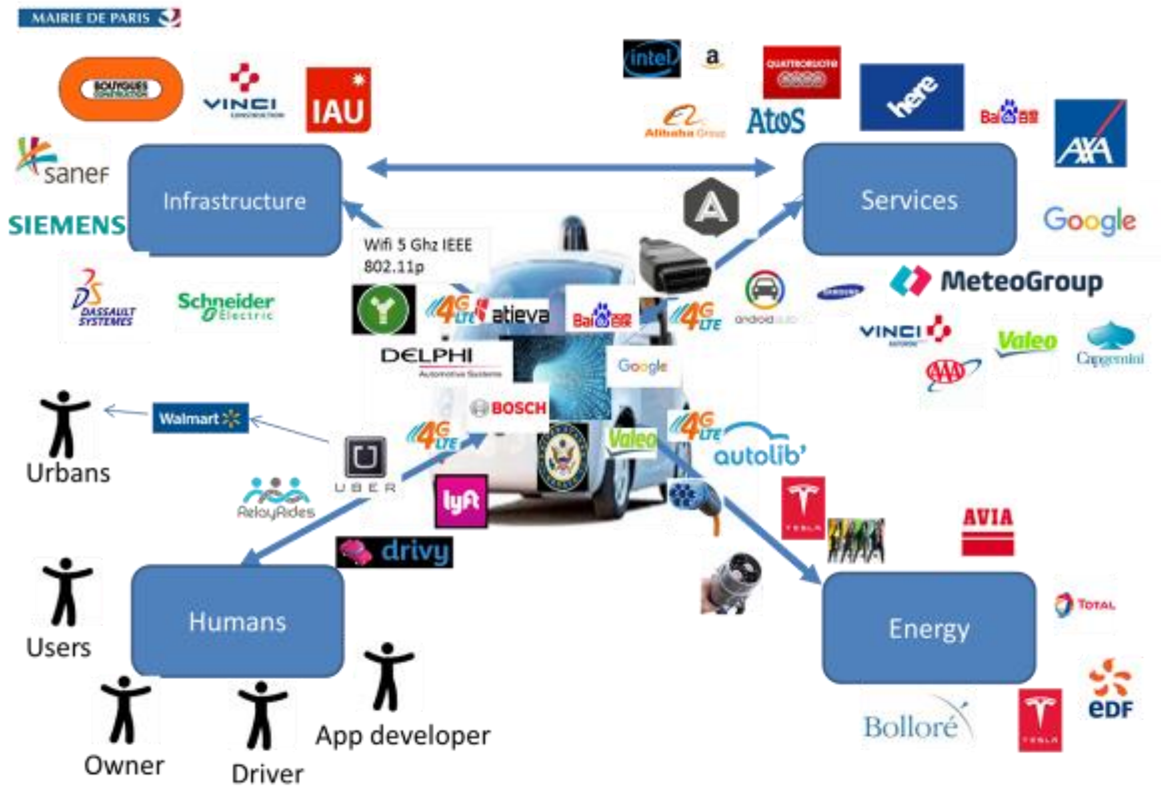
Table 15 Demand investigation on data packages use cases

CATEGORY	LINK WITH CONSORTIUM	EXPLICIT DEMAND	BUSINESS IMPACT FOR CUSTOMER	ORIGIN
	direct or indirect			problem or opportunity
Fuel Distributors				
	indirect	trafic flow forecast	investment decision on fuel	opportunity
		fueling habits	supply management, sales	opportunity
Highway operators	indirect			
		more information	road safety increase	problem
		more information	road green performance	opportunity
		new services	revenue increase	opportunity
Health Insurance	indirect			
		more information	reduce TCO of its fleet	problem
		more information	improve quality of home-work	opportunity
Urbanists				
	indirect			
		data on people	future vision for the chartes	problem
Smart City utility provider				
	indirect	raw data from	additional revenues from	opportunity
Local municipalities				
	indirect	driving habits and	Site attractiveness and value	problem
Regions				
	indirect	trafic flow and	selected area economical	problem
EV charging network operators				
	direct	charging and	revenue and maintenance	problem
Fleet management companies				
	direct	information on	TCO fleet reducing	problem
Interoperability platforms				
	indirect	static and dynamic	effective interoperability	problem
Car insurance companies				
	direct	driver and	Cost and fraud reduction	problem
Building companies				
	indirect	information on car	New revenues from Building	opportunity
Mapping companies				
	direct	real time	revenues from information on	problem
Weather forecast companies				
	direct	Information on	revenues from more accurate	opportunity

Source: (Maniak and Marcocchia, 2016)

This exploration allowed us to provide a concrete demand potentiality from known and unknown users of the platform, based on which the data package composition could start from the offer side. Furthermore, the above elements contribute to the design of the Marketplace emerging ecosystem:

Figure 50 Automat Connected Vehicle Ecosystem



Source: (Maniak and Marcocchia, 2016)

The discussion on customer perspective while searching for information on the marketplace made possible the transition to the following underestimated topic: the efficiency of transaction as key element of the user experience while interacting with the platform. The role of contract negotiator emerged as newly discovered and mandatory part of the marketplace activity. Starting from a list of features drafted at the beginning, the real competences and responsibility of the marketplace manager are widening following a discovery process collaboratively made by partners.

As several deliverable run late in this first half of the project, partners recognized that a result achieved but not considered upfront is the collaborative dialogue, which so far allowed partners to discover key features of the value proposition of the marketplace, but not only. A better understanding of the process of data collection and transmission, as well as the characteristics of marketplace management from a user point of view allowed each partner to integrate internally strategic considerations on their internal processes and business key factors.

A year after project kick-off, un-addressed requests on offer and demand sides, still persist. Service Providers are asking for real collected data to test, and OEMs asked Service Providers detailed definition of which data they need. Data availability delay on the OEMs side appeared to be linked to test design and organization within the companies. The initial approach of Automat participants within their internal organization resulted in slow response from the structure and low performance in reaction for specific test creation. One initiative was proposed, as linked in synergy with another one already kicked off and with the possibility of building a solution on data from other projects in order to save time and money. Another partner proposed a new test design (weather stations on an existing test track) which could be implemented within the organizational obstacles. It is the first time incumbent positions and declarations are shaken toward users' request and that space for agreement in request answering could be perceived. Data availability issue impacted the full compliance of deliverables with project activity as one of the core activities to prototype assessment (the data pitch) started to be debated as un-feasible before project end.

While debates on how to collect more data proceeded, the first assessment on currently available signals resulted in 21% of signals are shared among OEMs, making much lower than forecasted the available quantity of data to be aggregated and sold through the marketplace. Consideration on technical implications and business impact proceeded.

In order to merge technical and business considerations during this phase of the project, we articulated the offer progressive structuration through the CVIM with the "customer view", in the attempt to bridge both "sides" of the market, and to prefigure which data packages would fit with which potential customers. A preliminary matching proposition was formalized, on the basis of the preliminary data packages identification provided by OEMs partners of the consortium. An extract of the tool used to show the package matching is shown in the following table:

Table 16 Preliminary data packages matching.

CATEGORY	LINK WITH CONSORTIUM	EXPLICIT DEMAND	DATA ON DRIVER AND PASSENGERS					
	direct or indirect		Seat belts	Doors	Key nr.	Seat possition	Children security lock	Use of navigation (or not)
Fuel Distributors								
	indirect	trafic flow	x					
		fueling habits	x					x
Highway operators	indirect							
		more information	x	x			x	x
		more information	x					x
		new services	x				x	x
Health Insurance	indirect							
		more information	x				x	x
		more information	x				x	x
Urbanists								
	indirect							
		data on people	x	x		x	x	x
Smart City utility provider								
	indirect	raw data from	x	x	x	x	x	x
Local municipalities								
	indirect	driving habits and	x					x
Regions								
	indirect	trafic flow and	x					
EV charging network operators								
	direct	charging and						x
Fleet management companies								
	direct	information on	x				x	x
Interoperability platforms								
	indirect	static and dynamic						x
Car insurance companies								
	direct	driver and	x	x	x	x	x	x
Building companies								
	indirect	information on car	x					x
Mapping companies								
	direct	real time						x
Weather forecast companies								
	direct	Information on						x

Source: (Marcocchia and Maniak, 2016a)

The tool allowed the appreciation of the demand on specific sets of data. This information can be valuable for the reflection on which data sets are valuable for the minimum footprint to be ignited at the beginning of the platform adventure.

With this matrix, an iterative process of progressive refining on both sides, offer and demand, could start, leading to final formulation of new and viable use cases for data packages for Service Providers partners of the project.

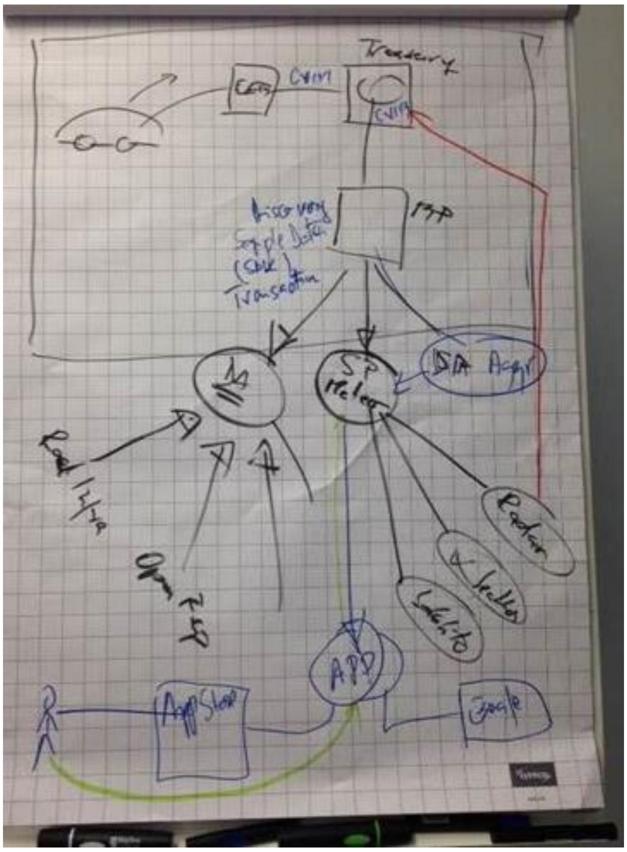
As far as technical implications are concerned, it appeared that the current data collecting infrastructure on the OEM's side, doesn't allow a more performant data collection, and that no modification in car equipment is possible during project duration. The implications of project development are recognized as potentially influencing decisions for future data logger and car infrastructure architecture and investment ("*The more performant device is not in the current cars yet. Decision for current production is done, and for cars coming on 2018, we need to decide now."* Telemetry services manager OEM).

As far as impact on business is concerned, the discussion on in mid-term of the project, they led to the aggregation discussion and on the role of aggregator as value capturer in the network. The scope of the bid slowly appeared to be too narrow compared to the ecosystem to be crafted from the data marketplace. Based on consortium discussion, some partners clearly stated the intangible and strategic value of the project. On one case, the evolved intention from a strategic positioning point of view was declared: "*Our future role is becoming to be the aggregator. We are preparing to become the biggest mobility aggregator in the global scale*."(Business Development Manager, Service Provider).

Nevertheless, the lack of quick return on current core business in terms of tangible value ignited a preliminary questioning on consortium participation interest on the other Service Provider.

Value flow have been actually designed in order to convey meaning and interpretation to the decision making process and its consequences.

Figure 51 Preliminary data packages matching



Source: Marcocchia, Automat meeting notes (2016)

On another case, the intangible value was recognized in the thinking evolution for strategic decision making: "*Decision on this project cannot be taken in a classical way. Business Model of Google twenty years ago was clearly a no-go. To make people thinking differently is the core of such projects, as it is for Automat."* General Manager, Service Provider.

At this stage of the project, the value chain as tool for the assessment of the marketplace value per actor and from a qualitative perspective was finalized:

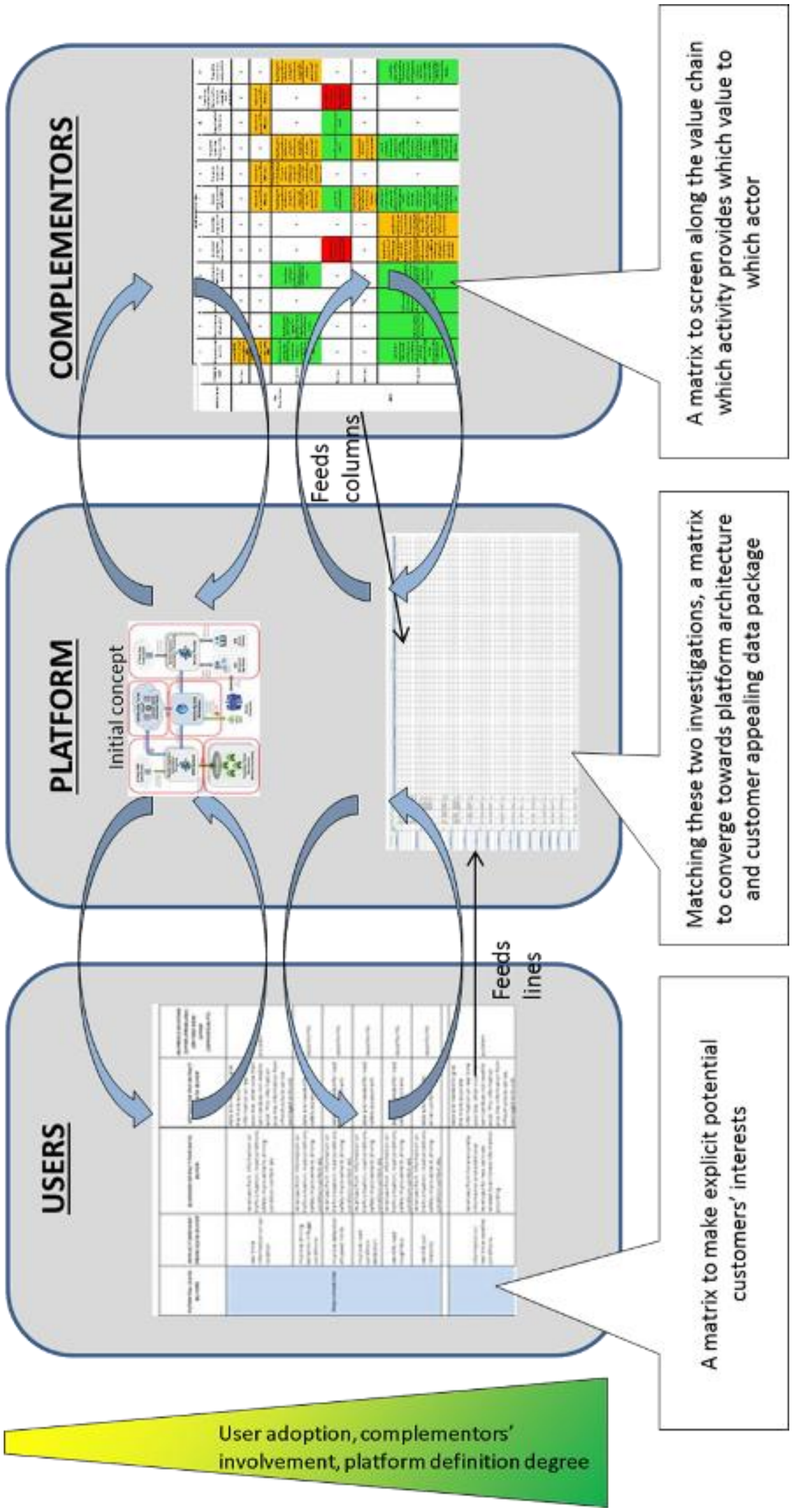
Table 17 Marketplace value chain assessment-Extract

		MARKETPLACE ACTIVITY FLOW											
		1	2	3	4	5	6	7	8	9	10	11	12
PARTIES INVOLVED	TYPOLOGY OF VALUE	Data generation and acquisition	Data pre-processing and aggregation	Data storage at OEMs Back-end	Data enrichment via OEMs internal knowledge	. Enriched and packaged Data storage in the cloud	Selected data packages put in the marketplace	Contracts management from C and B with OEMS.	Clearance for transaction to Marketplace	Packaged data transfer from Marketplace to C or B	Payment from C or B to Marketplace	Payment from Marketplace to Data Suppliers with fee retention for packaged data request management.	Packaged data transfer/service providing to C or B.
Data Generator/owner	Direct value	currently 0, but potential selling of generated data to OEMs	0	0	0	0	0	0	0	0	0	0	0
	Indirect value	currently 0, but potential percentage on data sale if data sold by OEMs	0	0	0	0	0	only in case of agreeement of % on OEMs sales	only in case of agreeement of % on OEMs sales	0	only in case of agreeement of % on OEMs sales	only in case of agreeement of % on OEMs sales	0
	Strategic value	Potential access to community for enhanced existing services or new services n transportantion related fields or in completely new field	depending on the processing and aggregation, possiblity of access to broader panel of enhanced or new services	0	depending on enrichment, possiblity of access to broader panel of enhanced or new services	0	0	depending on the service providers or individual users selling for the enhanced or new services to be provided and from which data generator might benefit as user	Following result of act 7, depending on the service providers or individual users selling for the enhanced or new services to be provided and from which data generator might benefit as user	depending on the service providers or individual users selling for the enhanced or new services to be provided and from which data generator might benefit as user	0	0	depending on the service providers or individual users selling for the enhanced or new services to be provided and from which data generator might benefit as user
OEMS	Direct value	0	0	0	0	currently negative for the payment of the cloud service to the service provider	0	guarantee of transaction later	0	action for payment collect.	action for payment collect.	currently 0, because of lack of price definition between demand/offer, but potentially cash flow incoming	0
	Indirect value	0	0	0	0	0	0	if contract forecasts percentage of fee for data multiple use with other actors than direct customers.	0	starting point for future cash collection in case of previous agreement	0	0	0
	Strategic value	high, for data acquisition on car behavior and performances, on car user behavior and profile, to direct and indirect exploitation through strategic partnerships and for capability assets acquisition	high, for capability assets acquisition in data enrichment	high, for capability assets acquisition in data management and consideration of better functionalieies of the backend infrastructure itself	high, for capability assets acquisition in data enrichment and internal department synergie for value creation	depends on the tasks partition with the cloud manager btw oems back end and cloud. As Automat platform is set, strategic value comes from learning practices with the cloud environment, and exchange of services OEMs and cloud manager might negotatie instead of direct value for data management	more data in the marketplace, more chances to have users interested in buying packages. This value depends also on the openess degree of the platform. The more open, the more strategic value from higher sales and new partnerships.	confirmation of interest in certain packages, and guidance for further products to be put into the marketplace. discosable information on contracts are elements to be used to prove to other potential complementors and other customers that marketplace is a valid platform to join.	0	prove of marketplace functioning and acceptance. link with C to understand how data are used from this point on in order to forecast which aggregation activities or marketplace services could be implemented to increase packages usability, and therefore platform adoption	0	0	link with C to understand how data are used from this point on in order to forecast which aggregation activities or marketplace services could be implemented to increase packages usability, and therefore platform adoption

Source: (Marcocchia and Maniak, 2016a)

On the basis of the two exploration instruments presented for offer and demand side, we provided then a process as a dynamic merging of the tow management tools. Named Significance Prober Process, it was aimed at structuring the partners' process of overcoming the Chicken&Egg problem through the iterative process of value chain definition and data package identification related to a potential business opportunity assessed through large investigation panel.

Figure 52 The Significance Prober Process: an iterative methodology



Source: (Marcocchia and Maniak, 2016b)

Debate on CVIM level of aggregation and data anonymization is still ongoing, taking misleading directions for level of discussion and perimeter considered (from data anonymization linked to the

car as part of the IoT, to impossibility of realization due to storage space in the cloud and business negative impact). The debate moved forward and finally from a specific, but unrealistic request on data collection and aggregation requirement, partners arrived to a realistic definition of demand to be used for the test under design at one OEM and for the experience to be kicked off with the low cost data loading equipment. The cars involved at each OEM's and the frequency of signals are limited in number compared to initial Service Providers' expectation.
So, tests under design will be different by the number of cars involved, the type of signals, and the typology of environment sensed (from test track, to urban and sub-urban areas).

4.3.4 Service provider partner replacement as a project performance enhancer: September 2016- March 2017

At mid-term, the open issues are still several, in terms of offer and demand, marketplace business model and user incentives definition, but collaborative initiatives on data package collection and tests are ongoing between OEMs and service providers. As far as technical knowledge, partners expressed their improvement on both sides knowledge (offer-demand sides), and the model pillar of the data packaging, the CVIM, is becoming more representative of the market needs.
As common data format, it is set to provide harmonization between signal descriptions, and the obligation of EC project delivery pushed partners to find common intent on such harmonization. Nevertheless, no common standardization can be found yet, and current state of harmonization presented by CVIM responsible showed that there will be several standards.
The lack of commonalities among OEMs measurement setting for the sampling and typology of signals (histograms against time series, dongle against built-in telemetry device) was a result of different internal measurement strategies and business scope of data collecting, as stated by one of them: *"Car is made to regulate phenomena in real time, not to store or to observe. The car is not designed for remember anything…OEMs do not want to pay for the highest quality standard. Only the time will tell which standard is the best"* Telemetry Service Manager OEM.
This un-harmonized approach on measurement resulted in a pessimist attitude of a Service Provider, who started to express doubts on the pertinence of its 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 Provider, which will have fed the internal strategic roadmap: "*I see now the strategic interest of building a bridge with Service Provider, within Automat scope or not"* R&D manager OEM.
As the review meeting with EC representatives was approaching, the attitude of partners moved

forward more collaboration in order to perform well at the meeting and to have budget confirmation for the second half of the project.

By November 2016 all first deliverables on all Working Packages were submitted and the mid-term review meeting with the EC commissioner took place at the end of 2016, with positive results in term of technical achievement, but unsatisfactory results in terms of information sharing on business model sensitive topics, and in proposals definition of applications from service providers inside the consortium. The review meeting was an occasion for the EC to highlights the rigidity of the H2020 project setting and to confirm the goals of project in terms of policy making realization and impact on the market.

Chicken&Egg challenge still persists, but more insights on how to progressively reach partial solutions appeared: "*The solution of Chicken&Egg depends on the use case. If there are more data sources available, we will provide service with much freshness.*" Business Development Manager, Service Provider. The contributions requested to partners for Significance Prober tool use were vain, as no cost reduction or price definition was clearly achieved.

As far as value perception, the project is still perceived as commercial-viability-oriented and exploratory project at the same time. As stated by an OEM: "*We do have a mandatory requirement which is to minimize the cost of getting data from car for selling it to car buyer"* Telemetry Service manager OEM. Some partners realized that part of the value of the marketplace resides in indirect value sources. The question on the business model is at the core of the discussion and the need of a "risk mentality" appears key to the partners in order to make business sense of the project. Some partners (OEMs) declared the gap between this approach and their traditional logic of business plan, but that the project has indeed a role in moving the debate forward, as "*Part of the goal of Automat is standardized data format, and have higher quality of the data. Next step is if the ecosystem takes off."*(Business Development Manager, Service Provider). In the case of one Service Provider, the creation of a brand new Smart City division (incorporating IoT and Automotive) was explained as an indirect result of the project itself, as well as the connection establishing with actors to be used in the aggregation platform under setting with their shareholders, were considered as intangible value already created by Automat.

At this stage, we proposed to implement the qualitative step of the value chain assessment, introducing real value or relative numbers (a percentage of a theoretical unit of data package cost).

Table 18 Value chain assessment with relative figures

PARTIES INVOLVED	TYPOLOGIE OF VALUE	**Management and Security Services**	Data generation and acquisition	Data pre-processing and aggregation	Data storage at OEMs Back-end	Data enrichment via OEMs internal knowledge	Enriched and packaged Data storage in the cloud	Subtotal
Data provider to Marketplace (OEMs)	total cost of each flow step	0,02x	0,2X	0,15X	0,2 X	0,3x	0,13x	X
	Human ressources							NA
	Fixed costs							NA
	Variable costs							NA
Cloud storage operators	total cost of each flow step	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,05x	0,05x
	Human ressources	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.		NA
	Fixed costs	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.		NA
	Variable costs	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.		NA
Marketplace operator	total cost of each flow step	0,001x	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,001x
	Human ressources		0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	NA
	Fixed costs		0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	NA
	Variable costs		0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	NA
Contract aggregator	total cost of each flow step	0,001x	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,001x
	Human ressources		0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	NA
	Fixed costs		0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	NA
	Variable costs		0,00 X.	0,00 X.	0,00 X.	0,00 X.	0,00 X.	NA
	High impact on cost							
	Medium-Low impact on cost							

Source: (Marcocchia, 2017b)

Nevertheless, internal processes and logics jeopardize the width of participation to such a project, as explained by one Service Provider*: "There is no way to convince our owners to share critical info within the consortium, and the business case was very weak... After a month of internal discussion, we deleted the initial test idea."* Such internal obstacles impacted also the communication performance of each partner, as actions to increase awareness on project existence and development were weak compared to EC set target. Partners (especially big corporations) stated the difficulty in taking initiatives on direct communication and in having the communication department acting, for both, internal procedure rigidity, and for strategic decision on content to be communicated. So far the lack of commercial or technical performances of the project, and the uncertainty of the use each partner will do of the results, will prevent any communication on OEMs and Service Providers' side. Based on the delays on test confirmation, the other service provider declared it un-matchable with its strategic decision making timeline on sectors of activity, and consequently changed its priorities. As automotive was no more the business focus for the future, they modified heavily their interest toward the project, with final decision of leaving the Consortium. A new partner is found by another Consortium partner and rapidly introduced to the others for approval. The new partner, a small agile company founded by an entrepreneur directly involved in the project, immediately expressed interest in low quality data to start with, and to have the ambition to a tool to provide a new level of service, not an incrementally improved one. The replacement of one service provider partner ignited a new vision on collaborative results achievable by the partners. Joint use cases of data packages are investigated and partners declared the potentiality of internal use of project results, as a project performance beyond already set ones.

As test design moved forward, some OEMs conveyed their frustration for internal difficulties in having the new test approved. Even if linked to technical features of the test (technical aspect of

data transfer), such internal obstacles delayed the kick off of the test, but the partial result of having some simulated data packages submitted to the CVIM was at least achieved.
On collaboration attitude outcomes, after a year and an half of project, OEMs started to share their experience in some technical features of data transfer flow, such as for the different format for interface and storage. The partners' involvement in the design phase allowed the clarification of critical features for user experience, such as drawing different hypothesis on how car data inquiry can be designed in the Marketplace webpage. A not forecasted visualization team was created to lead such key aspects of platform adoption.
On the demand side, Service Providers found a shared intent in typology of problem to be solved and scale for such action. A new idea of merged service was sketched, as confirmed by Service Provider Business Development Manager: *"Real life problems are the interest goal to us, and for being relevant with service on a global scale. Scaling is the critical thing, and you need to provide quality in services at worldwide scale. This is why we are interested in collaborating with Company 1 information on a global scale and merging weather information on maps*."
The pertinence of a more flexible strategy for project development is pointed out by some partners, as value creation is recognized within the project and internally. At this stage, attitudes showed sign of changes among partners, and within organization, Automat is used to communicate, it is recognized as experience enhancer on data collecting and team working among department: "*I am very happy, after all the discussions, things move on. This project is very important internally from the moment on which our boss can communicate on it. Several departments such as IT, R&D etc, worked together and it hadn't happened before"* R&D Manager, OEM. And the new team composition seemed to have propelled this result: "*I am happy about the new partner, and the willingness to work together he shows today. It seems now we finally have the good team*" Telemetry Service manager, OEM.
It is only in late March 2017 that all partners demonstrated enthusiasm toward the project and that to focus on internal goals might find its coherence with the project. "*We are not here to please EU, but to achieve our internal goals. Our motivation in participating is to learn something, to improve our products. We do not want to talk about ways on how to improve product, but we are still doing it. .....now the project gets exciting."* Business Development Manager, Service Provider.

4.3.5 Use cases boosting by a partially renovated Consortium team to first data availability April 2017- September 2017

The progress made in demand exploration via Service Providers and potential users' surveys, the changes in the Service Providers internal organization side for one, and in a new entity for the other, resulted in new proposition strength on the demand side. Use cases could be better identified and the offer tailoring could begin, adding elements to further define the demand, in an iterative uncertainty-exploration process.

The formal step of answering the EC recommendation after the mid-term review meeting allowed partners to share the real and the formal status of the project and to constructively discuss on the missing actions to be deployed for the time remaining in order to be compliant with the project's formal target.

The main problem in setting realistic solution for the chicken&egg problem is the lack of real and quality meaning-full data for Service Providers to assess value of it. In May 2017 it appeared clear that some of the activities initially included in the project, and in some cases linked to the result in terms of business model viability assessment, as the Data Open Context, could not be performed for technical (lack of real data), commercial (lack of appropriate budget) and project framing (project timeline and duration not modifiable) reasons.

OEMs discovered that, from internal confrontation with other departments, the real data capturing process has cost related which were not considered at the beginning of the project, and that the constraints on private data use are higher than appraised at project bid submission. The approach to test kick off conditions emerged also as a confrontation field among OEMs and Service Providers, the latter having integrated that in order to start playing with something, they would have had to accept to get fewer data than initially demanded. OEMs were facing internal obstacles in getting approval for new tests initiatives, as problems with sensors suppliers started to emerge and the wished amount of cars to be tested was linked to an internally un-approvable investment amount. The confrontation with sensors suppliers resulted in new dialogue on partnership typology between OEM and them ("*Sensors suppliers are playing political games. We are trying to make new deals with them, but it is hard*" Telemetry Service Manager, OEM).

The above discussion opened the way for an evolved understanding of the role of some activities included in the project, such as the business model assessment, as said by one partner: "*Business Model results will be more on how to build partnership and in re-organization than in finding a price or a cost*" R&D manager, OEM. The result of traditional economic tool analysis such as Profit&Loss was not confirming sustainability of the project, and value chain assessment move forward a step of deep investigation of the impact of technical scenarios of data collection on value creation and capturing:

Table 19 Value chain assessment based on data collection scenarios

Dimension B: Amount, structure, quality, signals and volume of data gathered - software configauration on the telemetry device - initial decision can be revised 'over the air' - the 'quality' chosen in Dimension A may limit feasibilty of certain choices for Dimension B		Dimension A: 'quality' of technical solution - hardware, concept and design decisions - needs to be decided upfront at vehicle design time, i.e. 4 years before entering the market - cannot be revised later			
		Low cost ELM 327 Dongle - existing today - no GPS, - no memory, no logic - connectivity only via BT-paired smartphone - only OBDII signals End customer price : 10€	**High-end Dongle** - existing today - with GPS, - limited storage memory, - with logic , minimal sensors - UMTS connectivity builtin - OBDII and ~100 diagnosis signals End customer price: 70-150€	**Fixed Installation Telemetry device**, - to be developed for mass production - with, GPS, memory, logic - built-in connectivity - full width of CAN signals available - capability for 300 histograms AND 100 TIME SERIES SIGNALS Target price for end customer: ~200-300€	**Full-scale data logger** - to be developed for mass market - with GPS - plenty storage memory - complex logic feasible - high frequency (>=10 ms) feasible - builtin connectivity - capability for 1000 histograms full width of CAN signals available Target price for mass market: 800€
	50 Mbtes per month (< 30 OBD II signals) - low-res time-series (1-10 sec freq) - no histograms - No GPS, *no usecase within consortium*	Scenario 1	makes no sense - hardware platform is capable of better quality	makes no sense - hardware platform is capable of better quality	makes no sense - hardware platform is capable of better quality
	100 MB/Mon ~ 40 low-res time-series (1-10 sec freq) w/ GPS but 100 high resolution time series too to be considered as high end attaignable with same dongle! (but the data capted depends on vehicle architecture)	not feasible	Scenario 2	makes no sense - hardware platform is capable of better quality	makes no sense - hardware platform is capable of better quality
	50 Mbites per month (- 300 Histograms - Geo histograms)--- AND TIME SERIES	not feasible	not feasible	Scenario 3, makes sense as entry scenario with lower cost than scenario 4, with option to upgrade to scenario 4 when market evolves	makes no sense - hardware platform is capable of better quality
	150 Mbites per month (- ~ 40 low res time series - 300 Histograms - GPS - Geo histograms)	not feasible	not feasible	Scenario 4, makes sense as entry scenario with lower cost than scenario 5, with option to upgrade to scenario 5 when market evolves	makes no sense - hardware platform is capable of better quality
	500 Mbites per month (- > 300 histograms - 100 medium res (100-1000 ms) time Series - GPS - Geo Histograms	not feasible	not feasible,	Scenario 5	Scenario 6, makes sense as entry scenario with lower cost than scenario 7, with option to upgrade to scenario 7 when market evolves
	High-resolution (<=10ms) time-series , up to full CAN trace 5 GigaBites per month, up to 1GB per Day	not feasible	not feasible	not feasible	Scenario 7

Source: (Marcocchia, 2017b)

Table 20 Value chain assessment based on cost typology

TYPOLOGY OF VALUE	**Management and Security Services**	OEM Backend Infrastructure design (1 in Europe)	Organising measurement campaign	Data transfer	Data pre-processing and aggregation	Data storage at OEMs Back-end	Data enrichment via OEMs internal knowledge	Enriched and packaged Data storage in the Vault	Data Packages transfer to Marketplace
total cost of each flow step for Sce	2%	10%	15%	6%	17%	5%	15%	5%	5%
Human ressources									
Fixed costs									
Variable costs									
Options for device in the car (fixed cost) :									
Scenario 2			F	V					
Scenario 3			F	V					
Scenario 4			F	V					
Infrastructure design (1 in Europe)	HR	HR	-	-	-	-	-	-	-
Organising measurement campaign	-	-	HR	-	-	-	-	-	-
secure data transmission	-	-	-	V	-	-	-	-	-
Receive raw data and stage (accumulation)	-	-	-	-	V	-	-	-	-
Decoding data (Pre-processing)	-	-	-	-	V	-	-	-	-
Transfer to the vault	-	-	-	-	-	-	V	V	-
manage data vault (users+vehicles+contracts+ligecycle+privacy etc)	-	-	-	-	-	-	-	V	-
Security	F	-	-	F	-	-	-	F	F
Data life cycle	-	-	-	-	-	V	-	-	-

Source: (Marcocchia, 2017b)

Since their presentation, the two levels of the same tool were used as base for discussion of all the consortium meetings, as all partners realized that the technical choice of data collection device has impact on the sustainability of the marketplace, influencing both complementors' and users' adoption.

As a complement to the above tools, the reflections on adoption dynamic drove us to propose a price scheme adapted to users' behavior. The Price scheme was named **dynamic PPPI (Pay per Play and Impact),** and it is formulated on the base of the link between price evolution and user active participation to scaling dynamics.

I(x), in which price is not constant, but might vary depending on uses quantity and on users' contribution to marketplace adoption dynamics. We identified four stages of the relationship between user and marketplace:

- i0: seller offers a free trial (price c0=0) to the buyer for the first T0 uses, and I0 impact on platform adoption

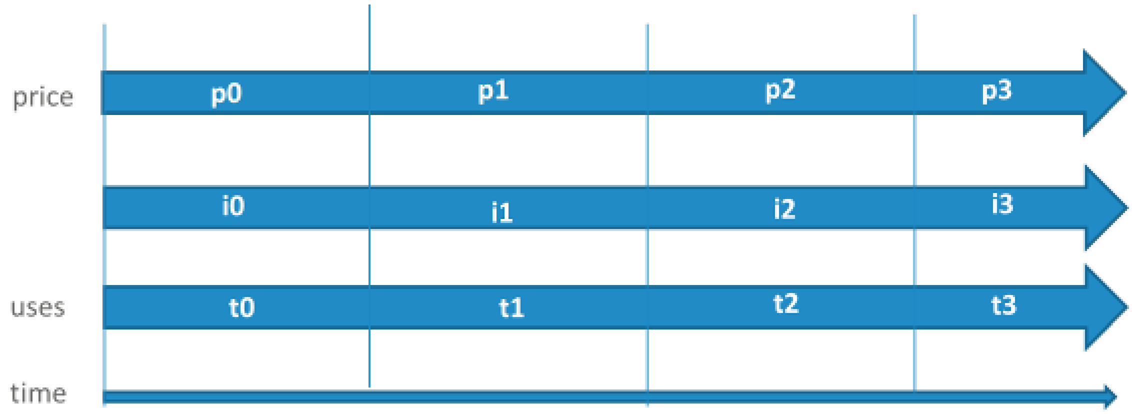
- i1: seller charges a constant price of c1 per usage thereafter, that is, pti = 0 for t1 < T0 and I1 < I0, and pt = c for T 1≥ T0 and i1≥ I0

- i2: seller charges a price c 2 <c1 for for T 2≥ T1 and i2≥ I1

- i3: seller modify price scheme from PPP to monthly subscription for T 3≥ T2 and i3≥ I2

Buyer's **value must exceed the current price**: Vtx ≥ ptx

Figure 53 PPPI model time-line



Source: (Marcocchia, 2017c)

Both Service Providers appeared to be interested in a scheme in which benefit on price reduction might be linked to their active participation to the platform scaling.

Nevertheless exploration of potential use cases within and outside the consortium needed to be performed as a result officially due to EC, and partners struggled to move forward on the Significance Prober tool proposed by us.

The lack of coherence among real development of the project and fixed target became clear:" *The project is not ready for further exploration on potential users. What we have in hands is not enough to get answers from potential users.* "(Marketing Manager, Service Provider). A modification on Business Model final due deliverable started to be discussed among partners, although project's rules do not usually allow the modification of a deliverable described in the Consortium agreement.

As debates go on for each features of the marketplace, spaces for solution started to be found in the semantic analysis of concepts related to the topics under debate. The basic unit of data collection, a trip, was deeply questioned, as well as the quality of the package, which meaning was not fully shared by partners. The test on simulated data allowed the recognition of insufficient amount/richness/spatial labeling of data, and the progressive definition of what quality means for the marketplace users. The fact that there is "*no precise request on quality and quantity of data. We have to learn from the data about the data"* (General Manager, Service Provider) translated the interaction modality of project partners into a "*We don't know what we need, we should play ping pong"*mode (Business Development Manager, Service Provider). The question of how to trust a new source appeared as well. As far as the data anonymization debate is concerned, solution was found in the semantic interpretation of it, on the open spaces left by the existing regulation on sophistication degree. This debated contributed to increase the value perception of project, as " *This project is an opportunity to see how things can work in a more restricted environment than US from a regulation and privacy point of view*" Marketing Manager, Service Provider.

Even if partners became aware of the different values the project is delivering (especially indirect and intangible), the rigidity of project management from EC and the lack of possibility to extend it for additional funding, made partners to formally declare that internal efforts on it will be concluded at project's end. The presence of some partners into several EC projects drove EC expectations on individual resource flexibility use for such partners, but internal decision on resource allocation is driven by internal projects benefiting from EC funded project result. The synergy on resources and results is done toward a long term strategic road map of the partner concerned. Discussion on this topic started at Consortium level.

Full prototype of the back end design was completed, although not implemented. Some OEMs declared interest in using the knowledge created to support the rational analysis of OEMs data management costs, with no direct or precise information on their side.

The implementation of the tests designed through the previous phases appeared to be more complicated than forecasted, and it delayed one more time the availability of real data for Service

Providers. Problems appeared to be more related to internal conflicts among divisions and confidentiality issues at OEMs, and not to technical constraints, as stated by a partner: "*It is about an internal fight at our headquarters. People involved in tracks do not really want to open up info for us*" (Telemetry Service Manager, OEM). On other side, the dialogue with other departments highlighted the relevance of the activity on data management, which drove into one case to the creation of a specific internal working team.

Any new idea or proposal potentially interfering with final deliverable due date were rejected by partners more involved in project management, and it created frustration on other partners which saw this attitude as a stop to value creation through the project (i.e. Project management responsible vs Service Providers). The opportunity of keeping working on it after project ends revealed more potential advantages in doing is, such as: "*By showing willingness to continue, we can influence future calls, someone backing you up in the call, modify the calls*.(Telemetry Service Manager, OEM).

In September, first real data are finally available from one of the OEMs partners to be used as a sand-box for service providers to check the correspondence with their needs in terms of quantity, quality and characterization.

4.3.6 Service Providers interplay with the platform: the achievement of an horizon of concrete interest and reciprocal trust- October 2017- April 2018 end of project

The availability of first data from one OEM was the inception of the real data flow from all OEMs partners progressively contributing in the following two months.

The rush of building content and implementations examples fuels the action of partners. The approaching of the project end boosted the discussion on final presentation agreement, in order to effectively use the remaining time toward formal contract compliance. During the discussion of final presentation content, the divergences of approach to the project still exist, and incumbent still expressed the challenge of considering such project as a data project and not an industrial one.

The awareness of the real problems faced by partners helped partners to explain the mismatching between certain deliverables request and the results achieved, as for instance: "*The time spent to find technical standards gave elements needed for the business model, and we learnt that business model could not be done upfront"* (Project manager, Project management consultancy).

The definition of standards and technical options for data collecting and transmission performed by OEMs, allowed the description of several scenarios to assess among partners for marketplace data feeding current option and technological future roadmap, in terms of technical feasibility and cost impact. This process of value chain assessment allowed the maturation of the idea that the path toward big data collection involves progressive investment on car equipment, which should be performed along with simultaneous progress in data use by first marketplace adopters.

The dialogue between Service Providers improved radically toward a better definition of package need and toward the aim of optimizing the demand of marketplace functionalities; it also allowed to discover functionalities to be implemented in the future which were unknown at project kick-off. Application use cases are better defined, and frequency requests became more coherent with real upload possibilities on OEMs' side. Dialogue on use cases highlighted the relevance of applications for autonomous vehicle scenarios, but such projections raised the opposition of some partner: "*But Automat is not designed for that!*" Telemetry Service Manager, OEM.

At the same time, technical features of the cloud infrastructure allowed the definition of the size of an average data package, which was a key element in order to define the usability of the platform itself toward users.

First feedback from the service provider is quite deceiving as far as the quantity and usability of data is concerned: "*We do not have enough data from OEMs so far and data do not have a sufficient level of quality, so we are 5-6 months behind in use case test. We have to go through a heavier pre-processing phase than forecasted.*" Account Manager, Service Provider. The amount of useable data was roughly 10% of the data uploaded into the platform.

Then partners engaged in a collaborative work on how to form packages at platform level in order to be more effectively used by service providers. Service providers started to formulate feedback and OEMs started to learn about quality characteristics of their own data, and where the value of them is. The approach of the winter season, and consequently the difficulty in running tests for several months, contributed to speed up the process of convergence between Service Providers' needs and measurement optimization at OEMs. It appeared that the tests ran so far contributed to improve one Service Provider's applications development, but as the number of tested cars revealed not to be enough to proceed with further use case assessment and implementation, OEMs proposed to collaboratively join forces for a larger collection procedure in a short delay.

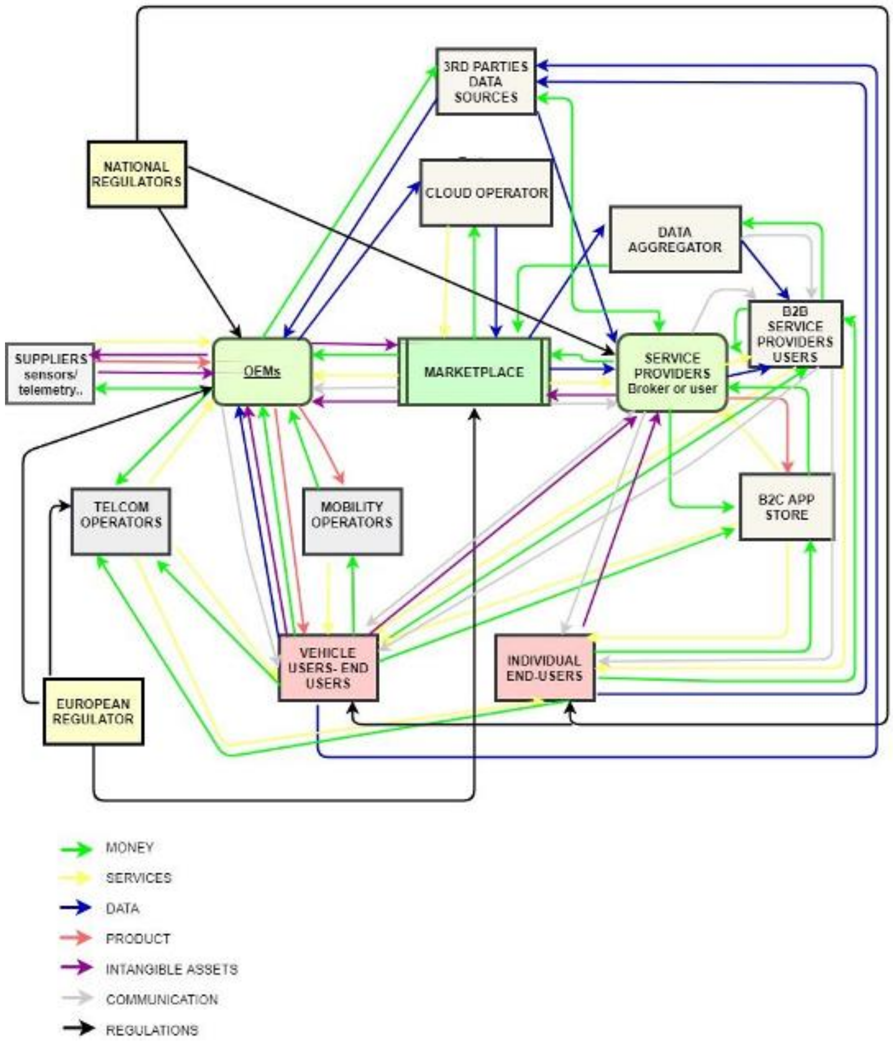
As far as the privacy and cybersecurity regulation framework is concerned, the European and international progression of regulations allowed the definition of a framework on which it has been possible to identify the improvement Automat can provide to global discussion on data use. :"*This project definitely allowed us to design a system architecture compliant with a security concept"* "(Cybersecurity Manager). Deep discussions on a new vision of data ownership resulted in a general alignment on understanding and even future legal aspects on data management.

Elements such the increase of urgency of complying with deliverable dates for marketplace prototype definition, service providers' use cases implementation and the lack of resources for keeping the prototype running after the project end, they drove the partners to the decision of definitely cancel one of the Working Packages (the Open Context) forecasted in the contract, and relevant to contribute to other ones (The Business Model assessment, as well as the final Marketplace prototype).

A few months before project end, the discussion on resources availability at the end of the project drew attention to the use of project results. The packages of aggregated data used in the project are new, with the new GDPR regulation coming into validity in May 2018, are not usable. Some partners already assessed the potentiality of cross fertilization with other internal activities, as stated by the Marketplace manager*: "We have plans to use the features and app of the marketplace, but not the data.",* and Service Provider*:" Parts of the project will go into other parts of your current activities at home".* Other partners revealed the potential synergies between car data and other vehicles data, discovered through the presentation of Automat project while performing dissemination*" After presenting Automat at the conference, the guy from MAN truck approached me and said there are data available from trucks equipped with telemetric. He would be interested in collaborating with us on merging data. This could be a great opportunity for us.* "

With all the above elements matured, we could design a comprehensive value network of the marketplace.

Figure 54 Automat Marketplace value network



Source: (Marcocchia, 2018)

Once the value network established, we could provide a clearer vision on the temporality of values:

Table 21Tangible and intangible values evolution

	TANGIBLE VALUE	INTANGIBLE VALUE
CURRENT	OEMs and Service Provider: first definition of purchasable package Marketplace prototype in terms of digital structure and technical features CVMI	Service Providers: Data treatment and model making for intelligence from data OEMs: Test design for collecting data OEMs: identification of factors influencing data cost and aggregation process All :Identification of links btw value chain and P&L dynamics All: the size of sensed environment/cluster must be optimized based on Service Providers local needs. All: knowledge increase in such projects to be applied to similar projects All: knowledge and awareness of privacy and cybersecurity Marketplace: interface usability

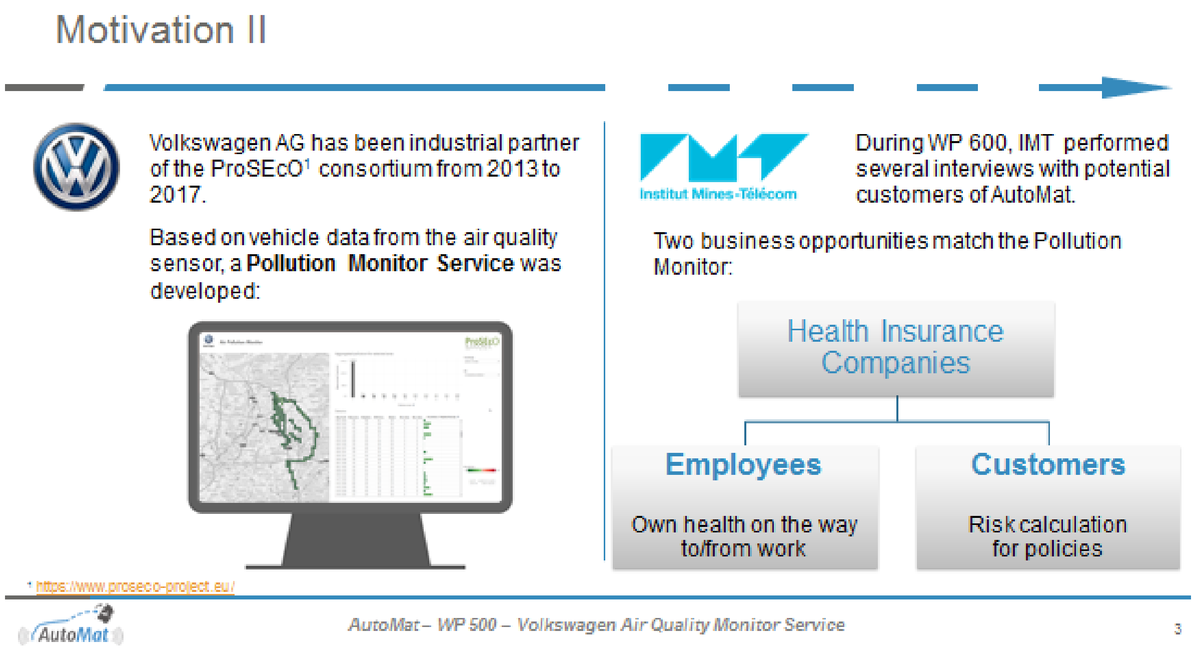
FUTURE	Service providers: new business development OEMs contribution to value proposition definition for service Providers willingness to pay ignition Preliminary hypothesis of joint service by Consortium service providers from Marketplace data Cost reduction on data aggregation Value chain cost driver optimization toward profitability All: Test design and data aggregation adaptability to local needs will allow higher adoption and willingness to pay for related packages All: higher performance and efficiency of project development in similar projects Higher willingness to participate from OEMs and Service Providers and end-users side, therefore more transactions. Higher willingness to adopt on the users' side, therefore more transactions	

Source: (Giulia Marcocchia, 2018)

Further use of collected data resulted in more use cases propositions by the Service Provider who joined the project in 2017, resulting in more optimistic vision on marketplace business impact on its side. Further use on the other Service Provider highlighted the need of more dimensions from one spatial and one time space. OEMs' answered to such a challenge by proposing a new sampling metric, the geospatial histograms, which will be specific to Automat.

Such proposal was then used to feed the Significance Prober tool in order to find a potential match with the opportunity investigation carried out in the first half of the project. Regardless to the reticence some partners expressed in mid-2017 regarding the iterative process of business model assessment, the use of the tool allowed the definition of a concrete business opportunity for the new metric. Such matching was then proudly recognized by the consortium and inserted as a valuable result of the project.

Figure 55 New Service identification



Source: (Zarcula, 2018)

Simultaneously, certain elements appeared to be keys in defining the value capturing of a potential industrialization phase for the Marketplace. For instance, the assessment of the most effective sequence on data loading infrastructure (data logger and data transfer band) highlighted incoherence among OEMs and Service Providers as far as acceptable latency, and the publication of the CVIM as open SDK at the end of the prototype phase is only now discussed as potential threat for Automat partners' exploitation of it. The lack of commitment among partners regarding the activities to be performed to industrialize the prototype jeopardized the solution finding on a common path toward value collection. The scenario "from final review meeting on, each for their own" started to be set, against the wishes of EC on long term commitment and short term job creation targets expressed on the project.

The collaboration attitude is then recovered by the positive judgement sought by all the partners at the review meeting, and certain topics resulted as areas of easier alignment among them, as it happened to be the interaction with automat marketplace and the definition of innovative content created.

The preliminary judgement of partners regarding platform adoption is that the focus to solve the lack of usable data should not be solved by proposing to increase users' adoption on the offer side, but to increase the data in terms of density of data in a given space by the current participating OEMs. A certain level of reciprocal trust is openly shared, as fuel for the last months rush toward final review with the EC commissioner.

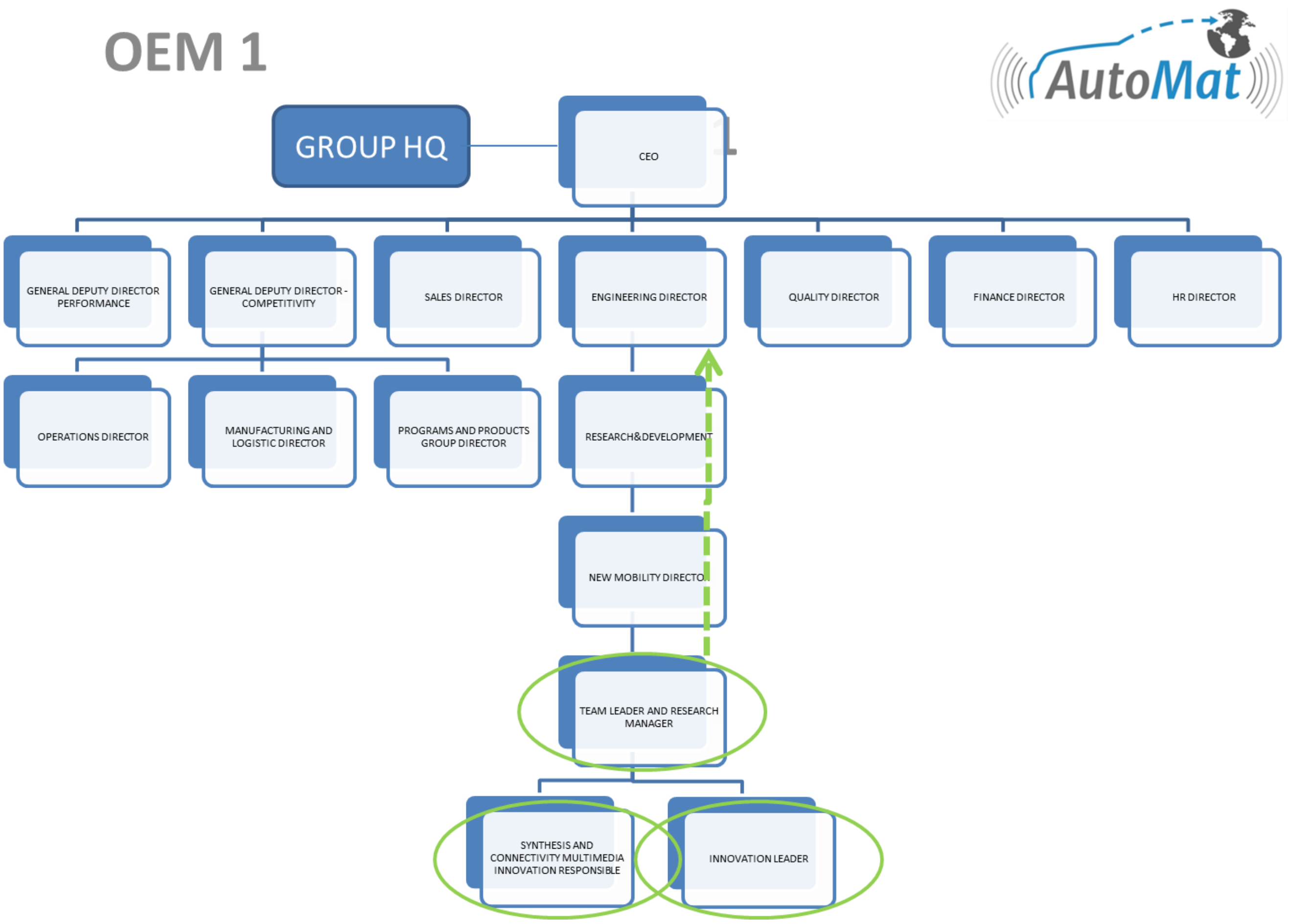
At project end, different results are declared by partners to EC. OEMs declared that "*we have learnt a lot. There are three level of harmonization to be developed, because we have three OEMs, but no further analysis on cost optimization has been possible.*" (R&D Manager, OEM). Confidentiality and lack of focus on data business strategy defined the boundaries of the collaboration and therefore the level of performance achieved. Declarations such as" *We are not a data company; we are good in metal, engines, and sometimes software*." (Telemetry Service Director, OEM) clarified the official position of certain incumbents, but other voices such as "*this project for us is very important because we understood on the data capture system issue, which is a way to reduce the collection……We are trying to figure out the best solution in terms of feasibility and cost.*"(SW Specialist, OEM) confirmed that indirect and intangible value have been created.

As far as the Service Providers value assessment is concerned, "*it was a very valuable proof of concept. CVIM and the marketplace proved to be valuable, impossible without a central standard.*"(City Solution Architect, Service Provider).

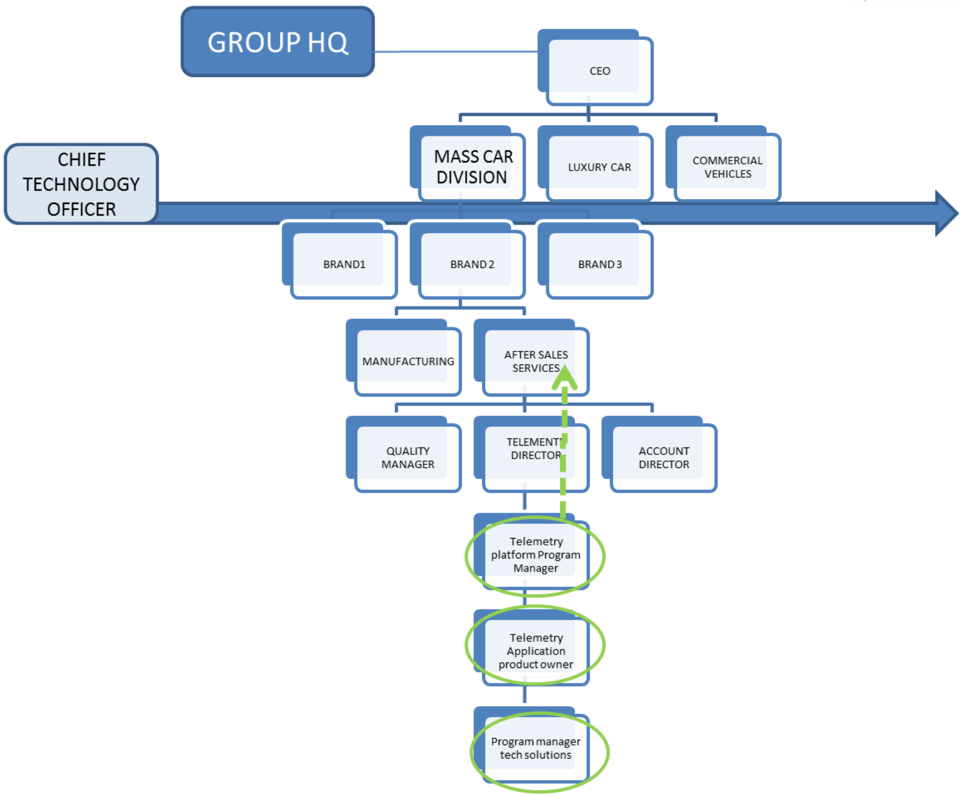
The take away from the funder perspective has a bitter-sweet taste. As expressed in previous meetings, expectations on their side were set on the establishment of technical implementation and business sense discovery through the Consortium composition, with long term commitment for industrialization. The reticence from European partners to bring the project forward can involve a concretization of "*threats of Google taking the CVIM and using it. Bring the experience to the decision makers in your company, because it is a pity. If you do not turn into a data company, someone else will do it.*" (EC commissioner, EC).

In terms of internal dynamics, Consortium participants were able to raise the awareness on project value to the high level of firm's hierarchy, as shown in the figures here below:

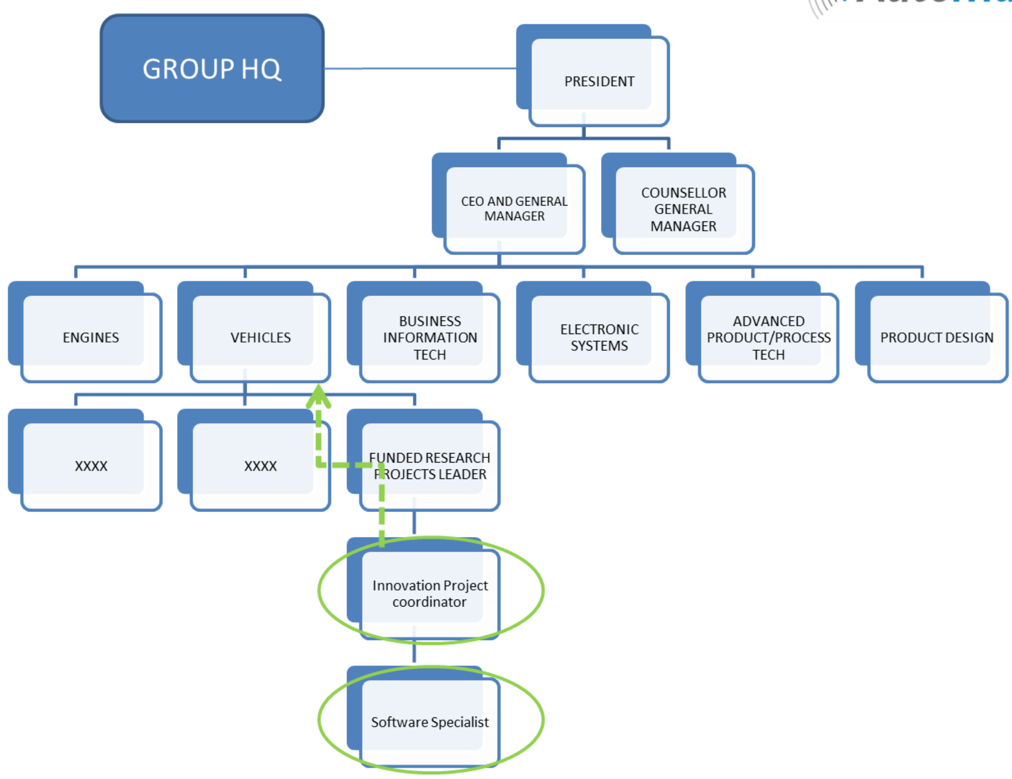
Figure 56Project visibility impact on partners' organization



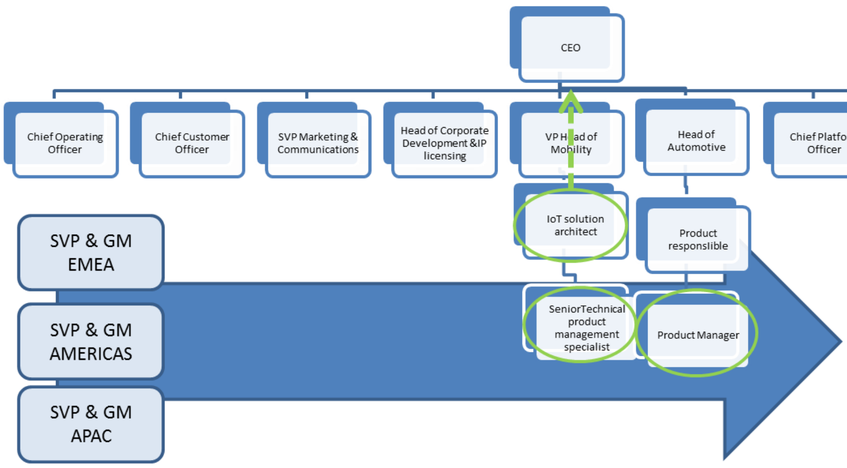
OEM2


GROUP HQ
CEO
CHIEF TECHNOLOGY OFFICER
MASS CAR DIVISION
LUXURY CAR
COMMERCIAL VEHICLES
BRAND1
BRAND 2
BRAND 3
MANUFACTURING
AFTER SALES SERVICES
QUALITY MANAGER
TELEMENTRY DIRECTOR
ACCOUNT DIRECTOR
Telemetry platform Program Manager
Telemetry Application product owner
Program manager tech solutions

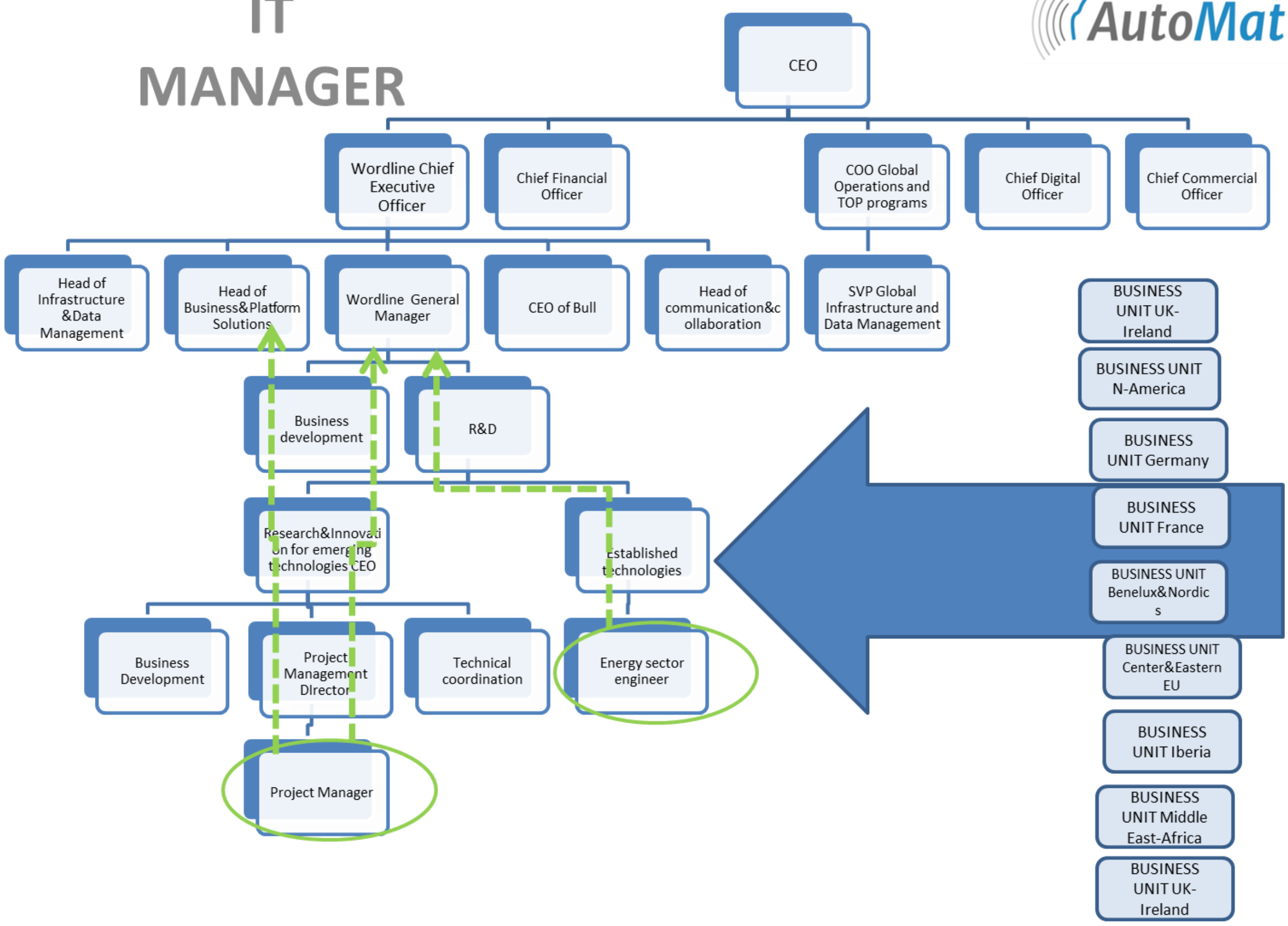
OEM3


GROUP HQ
PRESIDENT
CEO AND GENERAL MANAGER
COUNSELLOR GENERAL MANAGER
ENGINES
VEHICLES
BUSINESS INFORMATION TECH
ELECTRONIC SYSTEMS
ADVANCED PRODUCT/PROCESS TECH
PRODUCT DESIGN
XXXX
XXXX
FUNDED RESEARCH PROJECTS LEADER
Innovation Project coordinator
Software Specialist

SERVICE PROVIDER 1



IT MANAGER



4.3 Le Square- The vision of autonomous driving

The case shows how various players align in order to collectively build a value proposition for a future service based on autonomous driving, which should lead to value capturing and distribution coherent with incumbents' interests and local communities' needs.

The raising expectation for autonomous driving triggered by Google, and the discussion on the evolution of the dominant design for the automotive sector, all find convergences in the hottest debate of the future of urban mobility.

One OEM decided to take action for exploring solutions to be brought to this debate and empowered one of its open lab to federate actors for an open innovation project. The team grows, connections are made toward the design of the ecosystem of autonomous driving and heterogeneous knowledge merged much fueled by the action of individuals as part of the team. Their motivations, their own personalities and strength to reach a result aligned with their intention were relevant factors to the progress made during the project. Much of their action was possible because of the distance between them and their headquarters, a clear case of organizational ambidexterity, but further development of the project is concretely limited by the decision-making lack from hierarchical responsible at headquarters. Project time-frame needs in its deployment environment of use cases are in conflict with project time decision making internal to organizations taking part of it.

4.4.1 Initial settings

Digital technology impact in mobility industry reaches its highest level with the autonomous driving. Hardware manufacturers, software manufacturers, public institutions have to act more like musicians of an orchestra, than solo, but public/private sectors, hardware/software development processes all is driven by different parameters and operational logics. Projects are launched, but with a very large scope and therefore hard to achieve. As all its competitors, one major OEM player is seeking at headquarter level for the adequate strategy to dominate such debate and to set a path for a profitable position in the next years. The complexity of the challenge is translated into responsibility spread across the organization, and the autonomous driving topic is on the agenda of different divisions, with no clear intersection points or coordinated resources use toward a common goal. Divisions tackle the issue of formulating a profitable profit&loss with the traditional project management and industrial financial settings, finding no way toward positive results in the short-medium term.

In this environment of urgency for decision making, speed of technology evolution and hardware-software integration, and uncertainty of any ROI on autonomous driving, one initiative laterally located compared to headquarter set the ambition to find the way through the urgency, the speed and the uncertainty through open collaboration.

On the other side, a Tier 1 supplier is seeking its path toward the most profitable positioning into the autonomous mobility value chain, aware that the attitude of waiting for the OEM to propose components solutions is not the best strategy to settle into a dominant position for a future ecosystem based on services and experience structuring. The work on experience prototyping developed in recent years by a very small proactive team is not considered by the headquarter as a core product to be developed in the future in the context of smart cities and the team is frustrated about the limitation of use cases the software application will have if it stays linked to the giant company and the sell-it-to-OEMs approach. They would like to have the opportunity to apply it to a smart city real use case with a broader range of partners, but the headquarters is not giving the green light to search for it, as not a company priority.

As a foreground of this private actors-driven scenario, the race of competition of municipalities worldwide is getting harsher to being the smartest and greenest, to attract investments, tourists, inhabitants. Life quality and wellbeing become relevant factors in such rankings. How to increase such intangible assets through the development of new mobility services driven by digital technology and speed is a difficult question to answer with current tools, procedures, partners, and parameters. In such a scenario, Paris is no exception and roles as the urbanism and attractivity developer are seeking for initiatives able to provide answers. Paris manager is expressing urgent need of initiatives to be co-developed with them.

Besides initiatives and tensions at two globally active industrial players' level, and the ill-defined need of a public institution, an innovation management research laboratory with a proven expertise in automotive players strategy and dynamics management, is eager to participate to an open innovation initiative on the autonomous mobility ecosystem establishment, but finds hard to identify a project on which the settings can leave enough flexibility to tackle such challenge.

As the conditions for creating space and time for an exploratory collaborative projects emerges at the OEM's side, a collaborative initiative is set as complementary option to projects developed at the headquarter, and is conceived as fueled by the shared intent of some stakeholders, who are willing to take action in a non-traditional way.

The set of players is composed by one automotive manufacturer, one Tier1 supplier, one academic partner, one public authority and progressively involved external contributors as autonomous driving urban stakeholders (graphic designers, architects, urbanists, service designers, potential users, software developers, collaborative service platform managers etc). These actors unite effort in order to explore and converge towards a shared vision of autonomous mobility leading to future services. There is no formal frame or funding provided by one of the actors or by external entities. The project started in January 2017 and it should have last 3 months. The evolution of project deliverable definition and impact on partners resulted in an extend duration, and currently the project is ongoing (at November 2018).

4.4.2 The relevance of the perspective and the team composition: January 2017-February 2017

From kick off meeting, project description and performance differ from a standard project, as per the lack of performance criteria in terms of quantitative evaluation, and the focus in terms of vision originality within feasibility. As no players got a clear idea of the form of the target to be achieved, all agreed in applying a creative process to define both the offer and the demand of new mobility services. Players did have an initial clear idea of their expectations toward to projects, most of them in terms of open innovation development, and in terms of marketing for others ("*This project is for us advanced marketing to know better our customer and to take power before competitors*" Tier 1 Supplier).

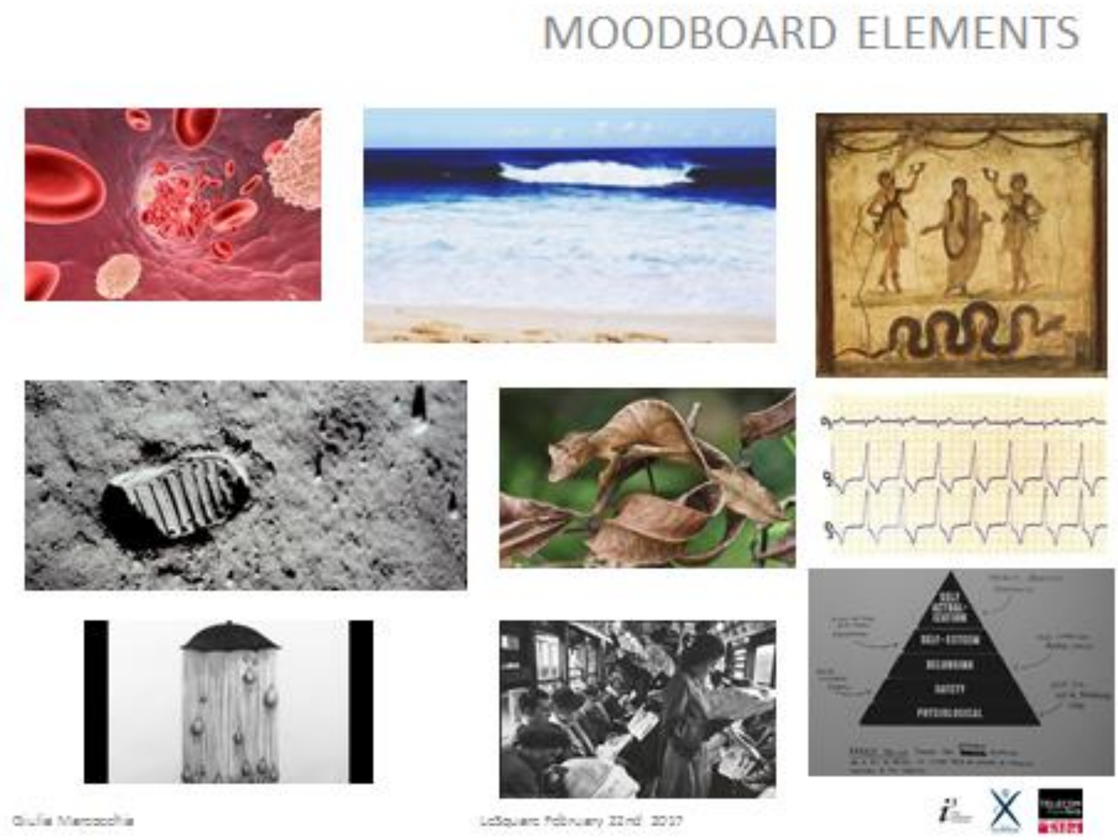
Since the very beginning, the process of vision shared construction was defined as a mix of creative methodologies, and more specifically an overall frame of design thinking with an exploration path based on CK theory. Team members shared knowledge and practices on above design theory and methods. The brainstorming and creative process allowed an initial shift from the consideration of the dominant design of a transportation object, to a wider consideration of the action within the urban environment. The perspective of the team changed rapidly to the exploration of a piece of urban mobility and not of a new vehicle. Simultaneously, the goal of the project was extended to learn how to work collaboratively.

The lack on initial specification setting was openly declared and accepted: "*The specs description of the concept will be done during the project and by all the participants, it must be collectively desirable*" (OEM).

The creative process was performed by using tools from design thinking (brainstorming sessions with jamming post-it) and the definition of the arborescence derived from the C and K space interplay from the C-K theory.

Mood-boards were used to contribute to the definition of the Concept 0 or the CK diagram.

Figure 57 Mood-board for Concept 0 exploration



Source: (Marcocchia, 2017d)

A tool created by one partner was fed by the completion of the two above and used to convey sense to the exploration conducted.

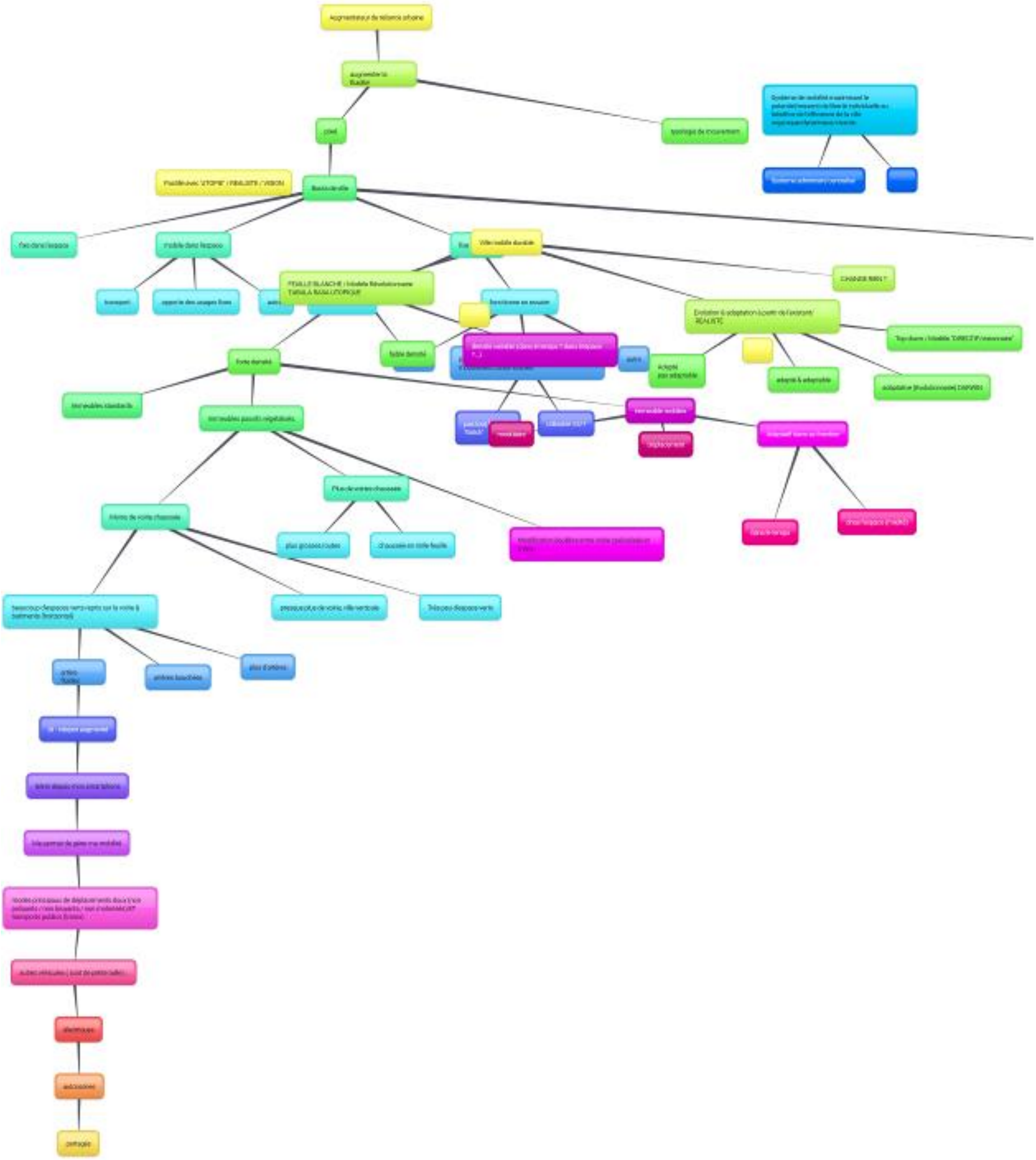
The exploration preliminary results have been discussed with a representative of the public local institution. It was the occasion to confirm shared interest in the exploration. The creative process could be pursued with the aim of iteratively reconsideration of the target perimeter and the width of the team to be involved. New knowledge sources have been added to the project, also in the aim of avoiding the reflex of getting back to the automotive dominant design along the process. The involvement of experts such as visionary architects helped that process: '*Mobility is a social and cultural issue before being a technical one. Companies must position themselves as providing tools for new dialogue*".

The relevance of the direct dialogue among players in confirming shared intentions and target was declared and the regular and purposeful involvement of players defined as key success factor.

Once the internal rhythm and setting were agreed upon, the need of external knowledge already emerged. The first input was requested in terms of municipality priorities, therefore in terms of city pain-points and parameters. The input on such subject impacted the consideration of which product portfolio should be defined for which impact, from economic and social perspective. As stated by the representative of the local municipality, "*the vision could be a deliverable to break traditional reflections, and to pave the way for experiments….It could improve dialogue among municipalities, which is problematic and it lacks coordination*".

The first concept of the C-K methodology was then found, and describing the vision became then a shared innovation field to be developed jointly by the project team with the municipality support.

Figure 58 C-K diagram for the Square project



Source:(Marcocchia and Unger, 2017)

The local solution starts to appear as a way to conceive global solutions, which is a reverse-flow from traditional innovation approach from large companies, partners of the project.

Additional sessions of open discussion with stakeholders were added and the internal debate resulted in widening the scope of the target of the project and in an extension of project duration. Declarations, such as “*Mobility is a social and cultural issue before being a technical one. Companies must position themselves as providing tools for new dialogue*” (Urbanist), contributed to the discussion depth and width. Project deadline was declared obsolete and extended of one month.

4.4.3 Discovering the augmented target: March- April 2017

From the initial concept defined in the first months of project development, some partners expressed interest in the project from a new approach, as communication tool toward internal hierarchy.

As the creative exploration was kept open, and external players as municipality representatives started to react to the intermediate results, partners realized that pain-points of users, citizens, were not correctly defined, and a deep work on semantic questioning on key definitions was performed. It allowed to clearly define the pain-points and to move forward for solution proposals, and a broader understanding of the relevance of certain definition (e.g. public space). The re-definition of the initial concept generated the emergence of tensions not previously considered.

As the players circle keeps enlarging, pure creative sessions are alternated with sessions on which external knowledge is provided to the team, but in a non-structured or rhythmed format. These interruptions resulted in some meetings on which the team discussion was driven toward a more individual-target goal. In certain occasions, the tension solution finding process was perturbed by the upfront declaration of unfitting of a potential object as project output with the current available product line of the OEM. While stating such unfitting, players declared a poor storytelling linked to an existing production object to such a visionary project target.

Team members realized that the project could be a way to perform shared knowledge and participants’ intention convergence, to be used beyond the scope of the project itself, but that would keep requiring collaborative approach in knowledge sharing and process steps iteration and pertinence verification. 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.

While project deadline was approaching, team realized that the definition of target of the project was knowledge building and structuring, and consequently the structuring of a multi POC strategy, based on a vision larger than a single POC. The sense making of the project evolved toward a lineage of a multiple results instead of a single output.

The creative process integrated a challenge of the state-of-the-art of creative output with an information graphic designer. This generated an open debate on which another level of scope widening was reached: the project is able to generate two main strategic results, one external and one internal to participants' organization. The external one is the ignition of interactions among stakeholders of an emerging ecosystem, the second one is to define the experimental process as an effective one for innovation ignition and for knowledge structuring among heterogeneous actors.

This awareness acted as knowledge-box opening for each team member, who shared experiences and useful feedback from previous projects. Project goal was openly understood and assumed as vision toward actionable objects, and pilot concepts have been challenged for further development.

At the end of March, when national municipalities' leaders were launching the white book on mobility for 2030, project deadline was postponed of another month.

4.4.4 The development of the two deliverables for a vision May 2017- Sept 2017

Since early May, the project team acknowledged a paradox of interests between the municipality and the OEM in terms of attitude toward vehicles presence in the city. The paradox became evident in the elucidation of the meaning associated to several words used by the team and received by the municipality with a different meaning and therefore implications in potential further decision making. What was considered value generator by the team has an ambiguous meaning for the municipality, potentially leading to public manipulation. In order to solve this paradox, the team needed to reformulate mobility problems using the language of local municipality. New external knowledge has been searched as far as law implications, use cases and maker participation. The need of making the vision tangible emerged and two concrete objects have been identified as means to convey the vision message:

- An infographics elaborated by the graphic designer included in the team in the previous month

- A simulation of a real situation in an urban area, with potential evolution to an augmented model.

Artefacts, physical and digital, impact the path of partners' dialogue: "*Infographics should work as tangible tool of discussion, practical and effective*" (OEM).

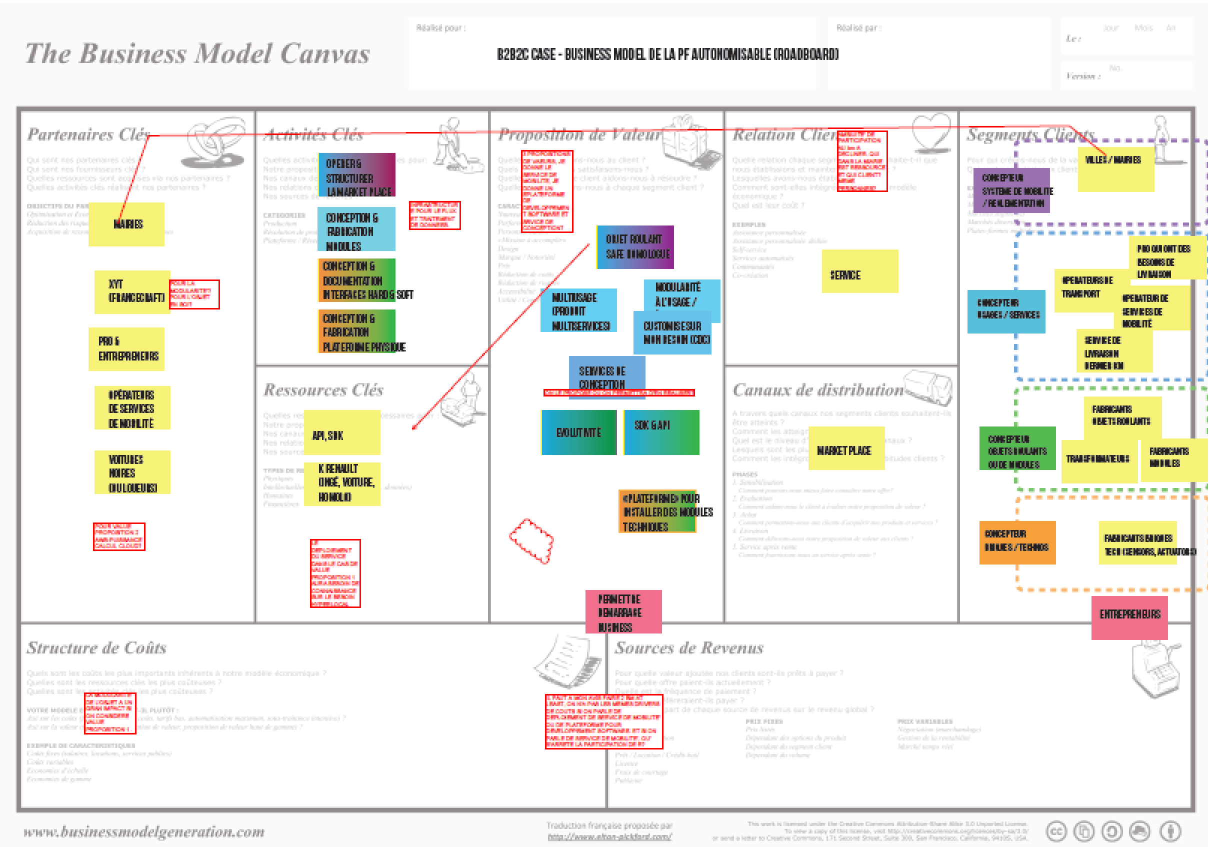
Partners started to apprehend the project as an arena in which tools are created and tested, and two more partners have been called on-board. New partners demonstrated enthusiasm for the initiative, matching with their wish to overcome internal innovation roadmap frustrations: "*Our objective for being here is to show internally that there are new forms of merging innovation challenged through* *collective projects, and that new tools can be created through them*" (Design Manager, Software Company).

As a further step toward collective understanding and participation to the infographics, the team organized a workshop during which all partners discussed the work-in-progress document, and agreed on several setting of how the information on tensions and problems will be visualized. The need of generating and align on a visual grammar emerged. The workshop resulted in the definition of three main concepts to be further developed by the team as next step of the project. Based on the discussions animated during the workshop and in following session, the team realized that the process allowed the alignment of the intents among participants, which then became closer to bias but with a certain degree of openness to be augmented or modified, if modification collectively accepted.

Since early September, partners visualized the deliverable as a multi-form object, with a layer-based structure driven by technical standards and adaptation to use cases. Such vision of the deliverable drove partners to re-formulate the configuration into a seven-layer value proposition, configurable depending on the use case and modifying accordingly the related business model.

Attempts to define the value proposition through the established tool of Business Model Canvas (BMC) were performed, as shown in the figure below.

Figure 59 Value proposition definition with BMC



Source: (Le Square Team, 2017)

Nevertheless, the team switched quickly from the definition of value proposition with the canvas to a more holistic understanding of value creation and collection through value network design approach.
It was the “distillation” of a progressive awareness of a dominant design evolution for vehicle design. The team then agreed that in order to present it as a solid result, the multi-layer concept must be matched with clear deliverable in use cases, simulation model, business model and impact on mobility ecosystem.
The project was then divided into four working packages with relevant team members associated to each package. For the first time in the project, each team member got a defined assignment, with sub-team to act in parallel, while before everyone contributed to an all-shared activity. Time schedule changed accordingly and the weekly meeting, previously working session for the whole team, became moments of result sharing on each working package.
The technical standards considered to match use cases appeared then the main driver of layers definition, heavily impacting the way the business model was designed, re-conciliating the role of technology in a challenge highly characterized by social implications, as defined in the first phase of the project.
The above configuration of the deliverable transformed the understanding of the target related to business model design: the project cannot be associated to one business model, but to a multiplicity of them, on the basis of the number of layers considered and the associated use cases.

4.4.5 Project sense-making through internal and external communities October 2017-December 2017 end of participation

At this stage, the project team decided to focus on local impact of the project for defining later a more global impact, and decided to include even more participants from the open lab community. A workshop on smart city was organized at the open lab and more people got involved in the reflections of the relevance of autonomous driving based services in urban areas.
As results of the workshop and ongoing work-package development, the deliverable of the project evolved toward the inclusion of a process as a deliverable itself, as a way to show a new path to object creation, which goes with business model definition along with technical constraint liberation, once uses cases have been considered. The team matured the awareness that use cases will allow the liberation of technical constraint. The access to virtual simulation seemed the step for injecting confirmation and evolution for the ecosystem structuring and business model design, which must evolve in parallel.

OEM refined the internal use of the project intermediate deliverable, as "*the work on this project at headquarter level, is useful to make people reasoning on subjects such as AI and messages on innovative services can be transferred without being blocked by the headquarter rigidity of reasoning and approach. There are off the radar for political wars*." (OEM)

In order to include all the relevant knowledge on technical standards and use cases from design and sociology point of view, the team decided to explore the industrial and business model link with an existing and already publicly known OEM project and to challenge the project so-far developed vision and concept through a service design workshop, an check and ignition of new perspectives.

Two separate events were prepared, a meeting with the OEM team responsible for the development and deployment of the first production vehicle initially considered as the basis for the Square project, and a service-design workshop on mobility use cases, workshop open to external contributors.

During the meeting with the OEM team responsible of the parallel project of innovative autonomous vehicle, it appeared clear that technical and business goals of the two projects are set to merge to make business and industrial sense. The two teams shared industrial and project management issues on both sides, discovering that most difficulties they faced were similar and that the solution path was a converging one. The two teams started to pave the way to explore how the two research projects could get synchronized to support an existing production object experiencing sales volumes concerns. While discussing on how to perform the synchronization, teams were confronted with the obstacles of being located into separate units (R&D and Open Lab) of the same company organization chart, and with the actions authorization and coherence issues deriving from it. In both projects, the business model design is an ongoing process during the project development, but: "*it is not isolated. Some work on the Square business model is reusable for the XX"* (OEM).

The quest for project complementarity was then open, internally and externally.

Simultaneously, a first presentation of the modular object part of the deliverable was performed by some team members to potential customers in another municipality than the one partner of the project. The result was encouraging, as the municipality expressed vivid interest in the presented modular concept, but a lack of knowledge of the object in terms of feature and performances emerged. "*Potential partners are interested in the concept, but not ready to make an offer bid. They do not know how to compile the specification of such an object*." (Tier one supplier).

The service design workshop was performed at the open lab location, and it involved several participants from the service environment related to mobility (free riding scooter service), design teachers and students. The day-long workshop was divided into several steps, based on standard practices of service design workshop, using personas, and defining a daily journey for them, with pain-points at each step of the journey.

An example of personas targeted by workshop participants is presented below:

Figure 60 Persona for mobility service design workshop

Source: (Unger, 2017)

Participants were divided into subgroups, and as a result of the day, all three tensions defined by the team were confirmed, and two out the three tensions were addressed with partial answers. 2 out of 3 tensions defined earlier found partial answers.

Through progressive definition of the participants to the autonomous driving enabled services, the value network design could progress through team collaboration for a result, at mid-December as it follows:

Figure 61 From Post-it Jamming to Value Network

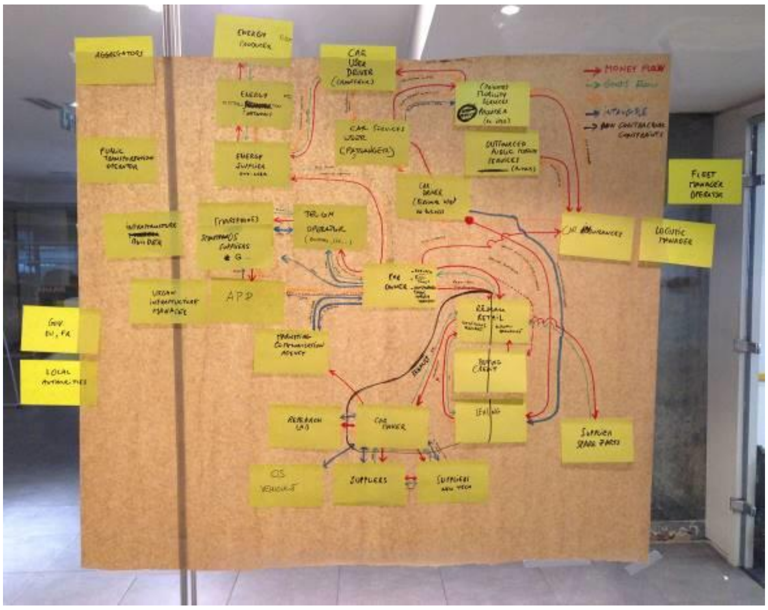
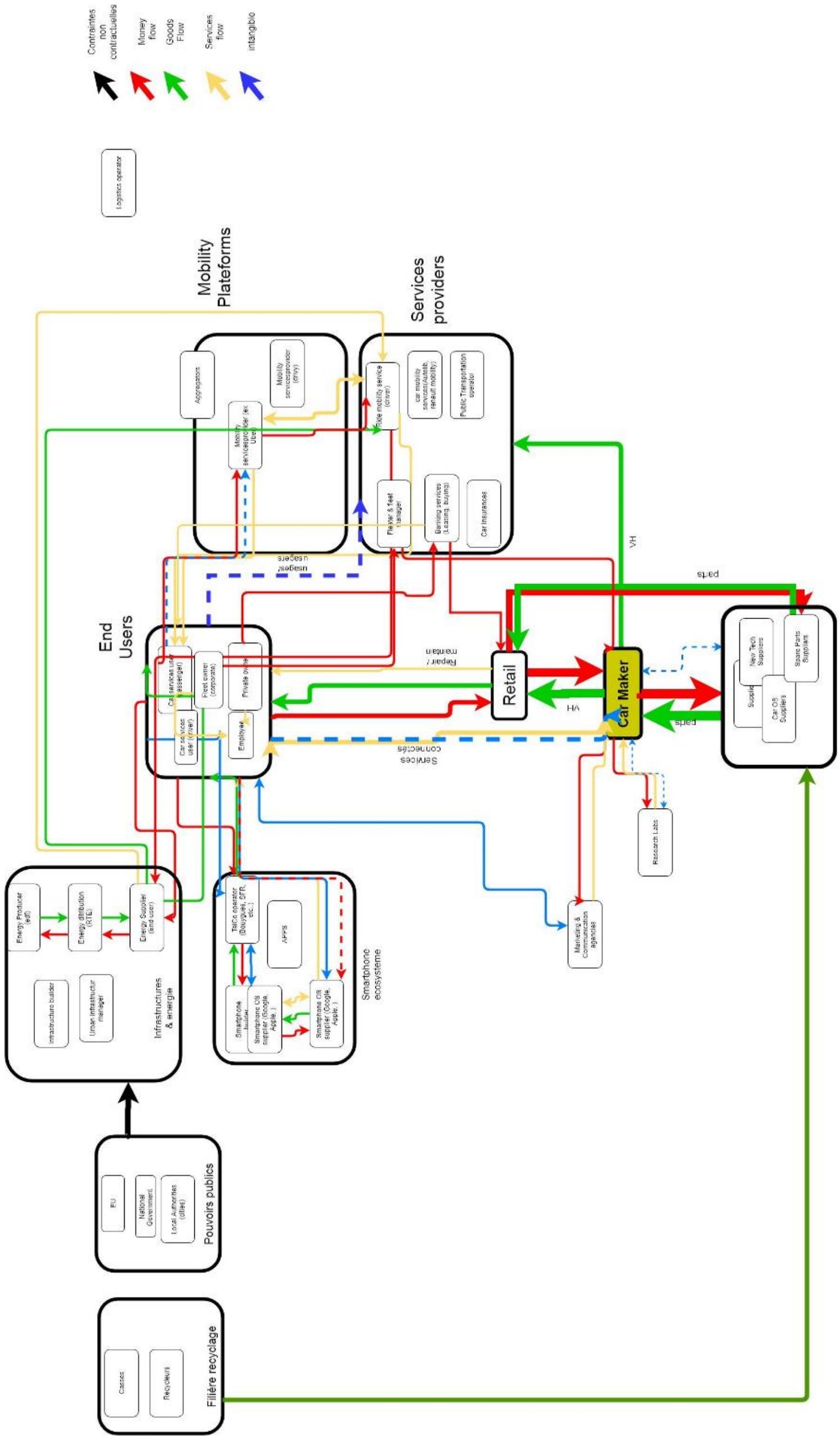


Figure 62 The clean version of the value network



Source: Marcocchia and Unger (2017)

The exploratory journey of the team was then concretely delivered through two objects, a vision billboard and the model of an object to be understood with the lenses of the vision and of the "layer-approach" to uses cases. The objects delivered by the team are presented below:

Figure 63 The final vision of the billboard

Source: Le Square team (2017)

Figure 64 The foam model

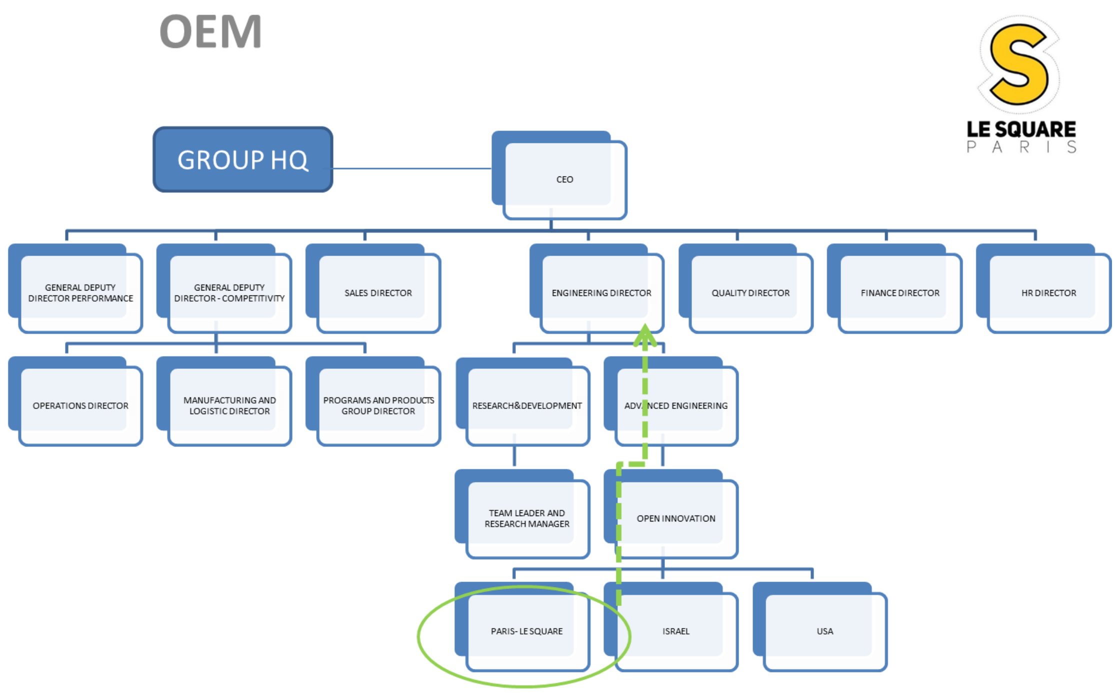
Source: Le Square team (2017)

The multiple aspects of deliverable value composition is finally entirely revealed: through the progressive alignment of partners, their knowledge background and the newly created knowledge, the deliverable becomes an object of convergence of technological solutions to match users' needs and an object of business intentions convergence for several actors.

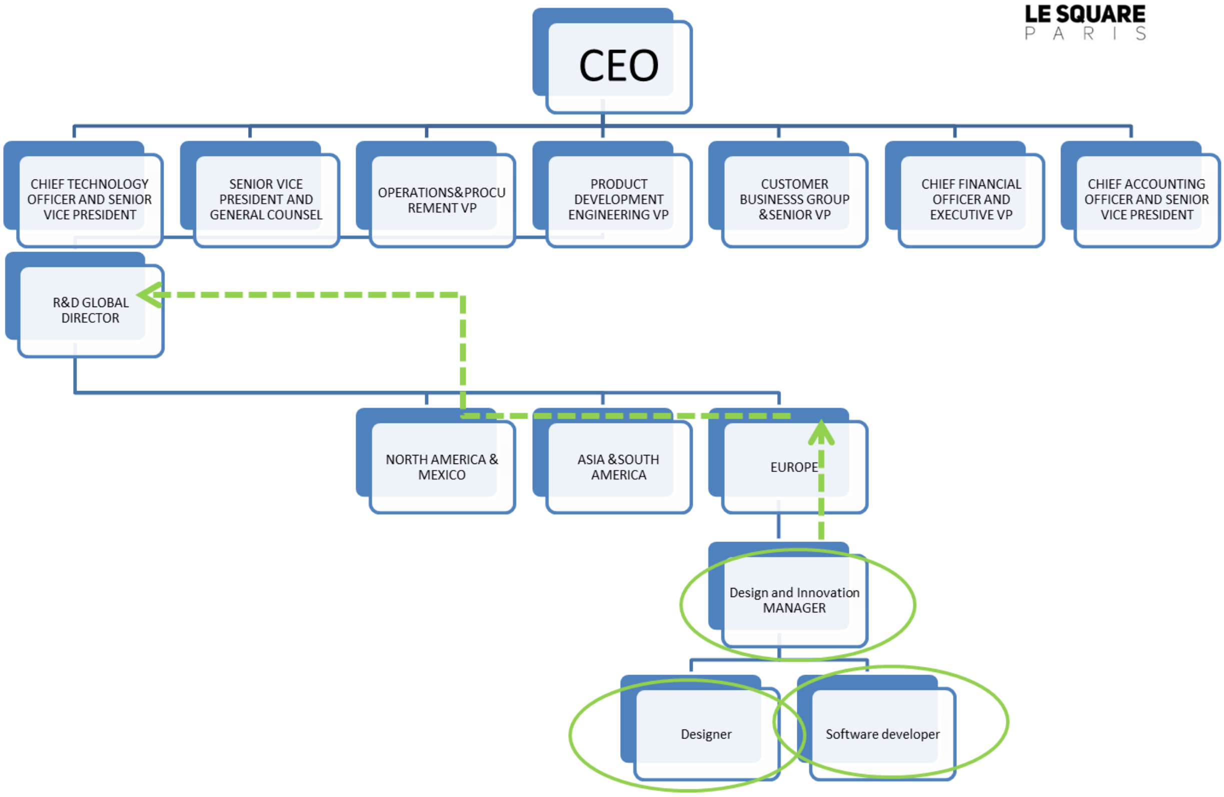
Team discussed of more intangible elements to be included as project performance indicators, but no decision was made in terms of formalization of a performance format yet.

In terms of internal dynamics, project participants were able to raise the awareness on the project value to the high level of firm’s hierarchy, as shown in the figures below:

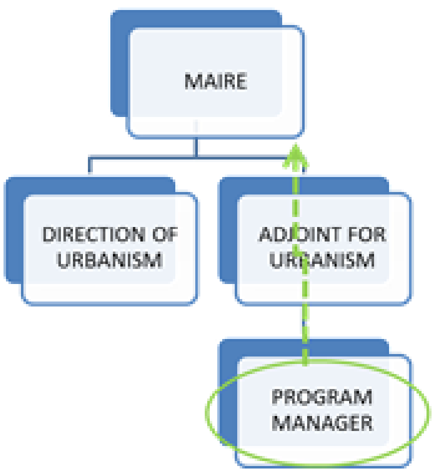
Figure 65 Project visibility impact on partners’ organization



TIER 1 SUPPLIER



PARIS MUNICIPALITY



The project gets internal and external momentum and the deadline is continuously extended as project deliverable expands. The working packages are set to be all delivered by the end of the current year.

5. FINDINGS & DISCUSSION

This thesis focuses on how to manage innovation in a context of systemic and disruptive innovation, and on the links between ecosystem and innovation management. We investigated the way players act while developing projects related to the structuration of the ecosystem on the basis of disruptive and systemic innovation. We have been searching for answers to questions related to the most performant pattern of management of such projects, as well as which organizational variables and mediating variables impact the pattern, and to which artefacts can better support such exploration process. The case analysis provided significant insights in order to see how and why behaviors evolve over time. We will first discuss the challenges ecosystem actors face during the projects' development. From the cases observation, we will present the driving forces determining actors' choices and the choices' timing for each project. These elements will drive us to the design of a common path among the observed projects, and the consideration of the role of innovation management practices (also through the use of artefacts) in the phase of exploration in case of an emergent ecosystem. Strategic implications will emerge from the above, such as the absorptive capacity impact of projects for participants, definition of roles of projects in the ecosystem emergence and in value shaping network, partners' engagement path. These strategic elements will be discussed as last part of this chapter.

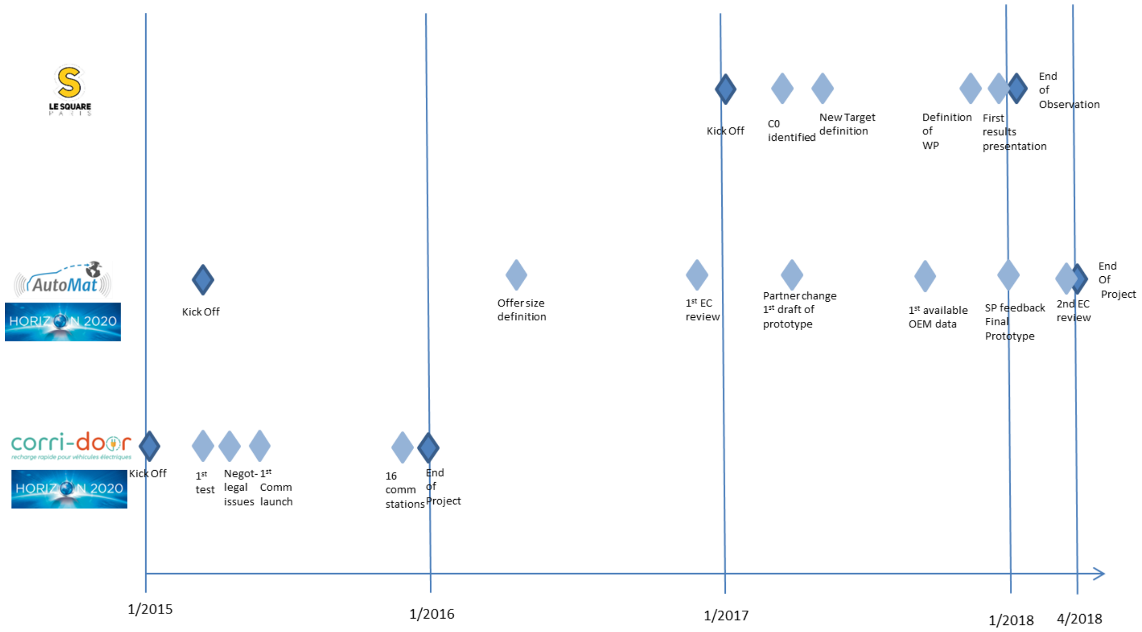
5.1 Overall remarks

The observed projects were part of the actions incumbents took in the last years in order to position themselves in the future connected autonomous mobility ecosystem, based on energy and data infrastructures. As detailed in Chapter 3 (Methodology), the selected cases have differences (which make them complementary in the observation of the innovation scope and in the ecosystem perimeter) and similarities, characterizing the panel as a comprehensive view of the autonomous connected vehicle-enabled ecosystem.

The three projects were all completed, and all through a certain degree of partners' alignment. We noted that the alignment happened at two levels, at ecosystem project level, and for the projects purpose with the partners' internal strategic roadmap.

From a timeline perspective, main milestones in actors' action and progressive achievements in collaboration and value proposition definition are represented in the figure here below:

Figure 66 Actions milestones per project



Source: (Marcocchia, 2018)

During the observation and participation to the projects, we had the opportunity to identify variables and factors related to the systemic and innovation management among partners and within partners' organizations. We identified elements related to the research questions defined as result of the empirical context assessment and academic literature review. The research design revealed to be adequate to the scope of the research.

The output of our journey is a set of contributions from the innovation management and the ecosystem strategy angles. The convergence of assessed elements resulted in a model of process, in a conceptual framework for decision making on participating on emerging ecosystem and related business model design.

In the following chapters, we will describe the discovery path we walked through in the last four years.

5.2 Project management issues in ecosystem structuring

In this chapter we highlight the findings from a project management perspective. The participation to the projects allowed us to access material on management challenges actors had to deal with in the context of the project, and in the context of internal organization. The engagement toward project completion, fueled by value-extension awareness matured during the project, revealed the relevance of such project in the path of organization's participation to ecosystem structuring.

Based on the data analysis and assessment, we can highlight that actors in the three projects faced the same challenges while jointly moving forward project development. Organizations faced challenges in terms of cognitive perception of relevant concepts, of the resources to be used, and the stakeholders that were in fact impacting the value proposition definition.

Such challenges evolved over time in all projects, but at different stages of the projects, with different interactions. We highlight the sequence and the links.

Then we described the preliminary result of a common path toward deliverable completion by partners, and the considerations on specific project management settings evolution in order to reflect on the performance of the project and adequacy of the settings.

5.2.1 Key Management challenges

From the analysis of data collected in the research field, we can inductively emphasize seven key challenges that each of the observed players faced.

The difficulties emerging from our assessment are related to several moments of the projects development. Since the very beginning, the alignment of concepts and representation appeared to be problematic as well as the definition of a value proposition meeting both demand and offer value perception in ecosystem participation.

In the quest of offer and demand definition, information sharing arose as key step, fundamental and simultaneously hard to achieve.

As such challenges emerged, the alignment of in-house effort with project effort was needed as by the legitimacy gained internally, partners could better act in the project toward its successful completion and for the strategic impact of the project within the internal structure. As time, quality and profitability of the projects were stressed, the resource allocation appeared to be inadequate and further input of external knowledge needed. The focus toward project completion emerged as an additional management challenge partners had to deal with.

During project development, the awareness of the strategic relevance of taking part to such projects evolved constantly among partners. From a limited degree of shown perception, partners had been able to evolve to the comprehension the enlargement of scope of the collective action.

Another challenge partners had to deal with was the necessity of considering a wider target of project, as the value proposition definition involved additional stakeholders' involvement and the value creation and capturing of the project should be done in a wider perimeter than the one initially designed. As the exploration of value proposition progressed, specific factors had to be recognized as ignitors to individual and collective action.

Let's discover in detail each one of the challenges.

A. Aligning concepts, representations, and defining value proposition :

Initially, each player had its own R&D roadmaps concerning mega trends such "Big data", "Autonomous driving", "Energy revolution", "Smart Cities"; high ambitions and systemic aspects are set, as sectors' and industries' boundaries blur and competitors increase by number and typology. Roadmaps concerning the products and services to be developed have been set, but incumbents struggle to establish a dominant position in the mobility value network. They all have previous experiences with related innovation initiatives, but none has internally the adequate resources for such initiatives, as topics are too distant from the current core business. Players individually have a weak position related to the performance in the above digitally-powered topics. The awareness of such position is also perceived by actors in other industries (such as highway operators), as coordination mechanisms among them and OEMs are not efficient.

The services provided by the platforms requested upfront investment and the participation of several partners in order to combine the value proposition; seamless charging for EV, usable data packages to be transformed into business by service providers and reliable urban services generated by autonomous vehicles, all need a certain level of common standards, and the joint development of customer acceptance toward platform scalable adoption for a still weak or not-existing market. Previous individual experiences in systemic innovation exploration and deployment resulted in diffused deceiving performances. As a consequence, limited resources were available for each partner for such systemic ambitions; resource scarcity jeopardized the creation of innovation space.

To counterbalance such circumstances, different collaborative opportunities emerged. In two cases, the "European Call for Project" appeared as a formally framed and reassuring opportunity for all players to explore solutions for such critical issues, while being connected with a relevant set of partners and through a financed project. In the third case, the presence of an ambidextrous unit of an incumbent allowed the kick-off of an exploratory participatory project with certain flexibility in partners' selection and project management. Partners were aware that the platform could not be built by one single actor, but they had the preconception that they can bring their own input without modifying it or themselves in order to contribute to innovation exploration and deployment.

Therefore, the initial purposes motivating the participation to the project were similar among the partners, mainly related to search alternative ways to exploration, to drive future competitiveness and to provide important positive externalities in terms of value and job creation.

Each player initially realized a certain degree of coordination with the others was needed, given the ambition and the systemic-ness. The "European Call for Project" appeared as an opportunity for all players to go forward on these critical issues, including converging toward common standard and enlarging the scope of their action for profitability achievement. The initiative of the Square project was perceived as the adequate frame for handling such a complex object as the autonomous driving in urban area. The project represented the opportunity to federate initially un-related actors toward a richer panel of exploration for a more actionable vision of the autonomous driving in urban areas. In all projects we noted that from the moment in which the project was initially designed and proposed to the EC commission and to the participants' internal hierarchy, proponents evolved internally in terms of strategy priorities and road-maps.

The two EC projects began with a "fuzzy" common vision of the future and joint interests. Industrial companies teamed together for a contractual engagement and apply, showing that they wanted to create value together in line with this vision. The Square project began with an unclear definition of project deliverable; actors teamed together for an un-formal engagement and started to dedicate resources.

Actors were facing **fuzzy wor(l)ds.** Even if the participants have shared a common project definition phase (file of project proposal, presentations, etc), many misunderstanding arose when facing the real work. At the beginning of the projects, we noted a fixed cost of lack of "inter-comprehension" among partners. In CorriDoor for instance, the plurality of applications and meaning for the word "interoperability" emerged as source of debate and learning space for partners, each one contributing from its area of expertise. For Automat's participants, the initial focus on marketplace's core input was on the innovative use of car collected "big data", but it rapidly appeared that the frequency and size of data collection was not symmetrically understood between complementors and users of the marketplace. Partners realized that real time had not the same meanings for the actors, and that big data should be redefined as big didn't mean usable or valuable. Data package identification needed to be still jointly defined by offer and demand side.

As far as the Square project, dominant design change was identified since the beginning as the needed step to deliver innovative service design. Nevertheless, it emerged that partners interpret in a different way the distance from current dominant design from the automotive industry, and a step of volumes' proportion understanding in a spatial context of the city was embraced as team de-fixation process. The word "community" generated also an "understanding space" among participants, as each partner's connotation of the term was initially linked to its business horizon. Such discussions were key to move forward to the exploration process.

Another relevant and repetitive misunderstanding was on the meaning of the term "business model". Often translate into a financially driven frame between revenues and costs toward profitability (as a more contemporary and fashionable way to say Profit&Loss), it was the object of dedicated sessions, involving different methodologies and artefacts, in order to allow a diffused and shared understanding of the complexity of dynamics a business model needs to capture and to deliver.

Value proposition definition required a high degree of collaboration and in the initial phase, partners of the first two cases adopted tools and methods not adequate, involving a focus on a pre-determined business model based on dominant design and processes linked to development and not to exploration.

The inadequateness of tools and processes was confirmed for instance by the difficulties in achieving the target expressed by CorriDoor members in the final report to EC, and on the harsh discussion among partners in Automat on the feedback of data packages use from Service Providers. Such moments represented a truth-injection event, on which most of the partners became aware and/or declared real conditions. In the AV case, partners embraced since the initial phase exploratory tools, being aware of the fact that a certain distance from the dominant-design-established-comfort-zone needed to be taken. Nevertheless, the awareness of real conditions was a progressive path to which elements were added continuously at the pace of team meetings.

It appears that there is a difference between people's beliefs and what is happening next, and that the bigger the distance of systemic innovation scope from the dominant design of incumbents, the bigger the distance between peoples' beliefs and real conditions. We can note that the divergence from project target increased from CorriDoor to Automat and then to the highest degree to Le Square.

We observed that the progressive enlargement of perimeter as a common trend for all projects determines the evolution of the role of the vehicle in the case of electric connected autonomous mobility ecosystem. In such ecosystem, the vehicle becomes part of the infrastructure itself, and when shared, it fully complies with the characteristics of a "*non-lieu*" (Augé, 1992), with specific contractual relationship with users and impact on users' identity definition, both underestimate by some partners. Incumbents involved in projects with an accepted (although too general) definition of initial concept, they focus on performance increasing for existing customers without considering the degree of destabilization of the relationship infrastructure-user, and the related need in terms of training and communication toward users. The key aspect of perception of function evolution of the innovation was not initially considered, neither new uses nor new users. Incumbents involved in project with an initially undefined concept, they kicked off the uses exploration, immediately focusing on perception of users and on the new relationship among infrastructure and the community in which the infrastructure will be deployed.

B. Information sharing:

Partners in H2020 projects had a perception of a limited degree of information sharing needed for the value proposition to be realized. In individual and then collective perception, the value proposition should have emerged linearly somehow from the agglomeration of each one contribution. The syndrome of "We already know what is needed to know" was quite diffused among incumbents. The reality of the process of value proposition definition showed since the early phase how complex the contribution in terms of information and knowledge sharing will be. In the fear of losing power on detained information, partners' first reaction to other partners' need of information was a negation within the project context. The quick rush back to internal rules to protect themselves from un-precedent position of sharing certain information or data represented a fixed cost for project, as for instance in Automat OEMs immediately declared they could not share data.

As project completion could not move forward without such sharing (i.e. technical information on charging specifications for EV, or collected data typology for Data Marketplace), partners had to move one step forward and open the "secret" book of their internal information. In some cases, they seek for internal authorization before performing the sharing, depending on the hierarchy level of the project participant. The awareness of the quantity and quality of information sharing appeared as the project deliverable completion were put into danger. Players realized they needed another round of internal authorization and this could represent an obstacle to project completion. From an initial shallow perception of information sharing, partners discover that the lack of trust in sharing as much as the project demands to do it is an obstacle to completion. It is the moment in which partners realized they have to go a step beyond, and this is a source of tensions, among partners first, and internally for each partners. The kick-off of a project could be mistaken as a sign of alignment on such elements, but instead ecosystem projects start with a « hard » phase as their completion demands internal engagements that each partner had not forecasted and that it could have not obtained without the project.

In our cases, usually one partner started as "early opener" and the rest of the team followed at paces dependent from internal culture and procedures.

In the case of the Square project, information sharing was fostered by the awareness of participants of the novelty of the subject. Internal organizations were part of the information sharing by informal participation to the project meetings. The use of design methodology eased individuals into information sharing in unconventional ways. Sessions were perceived an occasion for all participants to broaden the view on the subject, instead as a threat for company's secrecy.

The level of sharing globally increased throughout the projects, with the intention in some cases of keeping the information flow open as occasion generator of future research project joint participation.

C. <u>Aligning the in-house efforts with the project efforts</u> :

In terms of efforts deployed in the project, participants experienced a double layer of coherence: at the project level, partners' efforts were initially driven by those who initiated the project. In H2020 cases, several debates originated from the project manager attitude of pushing participants toward project development suitable for the project manager's individual goals. Participants needed to deploy efforts within the project to generate the value proposition, and then to defend such value proposition through other efforts deployment within the internal structure. Let's take the case of data packages definition in Automat. The data package format Automat project manager was insistently pushing since the beginning was conflictual to the package configuration platform users wanted to test. Such conflict could be explained by the fact that current organizational settings were not defined on the basis of a holistic vision of a platform-based service to be deployed, but on dominant design linear process of value proposition creation. As example of observed conflict, in the Data Marketplace project, as a new definition of "data quality" was achieved as key step for the Marketplace value proposition definition, OEMs needed to deal with internal decision making processes. On the OEM side, decision making processes for device investment authorization had been challenged as the validation of the relevance of certain data collection and related investment authorization, were blocked by current decision making processes.

Partners discover progressively not only the real strategic agendas of other partners, but the connection of the current project with other exploration projects among their organizations, which contributes largely to the mentioned follow up decisions. Such exploration projects, ignited by systemic and disruptive innovation and contributing to ecosystem structuring, they are kicked off at a medium-low and mono-capabilities hierarchical level, while their ambitions are situated at a higher level in the organizational structure. The challenge seems to be the legitimacy construction on horizontal and vertical levels within internal organizations. On the horizontal dimension, they have to achieve a certain number of internal stakeholders' interest and engagement, through a transversal alignment. On the vertical dimension, they have to gain the support and commitment of the highest level of the decision makers' pyramid, which will impact the legitimacy construction on the horizontal dimension.

In all projects, incumbents discovered progressively that the struggle with internal organizational obstacle, was indeed at the source of several positive impacts such as the ignition of internal dynamics directly and uniquely linked to the project, the insertion of new topics in the innovation agenda, and the delivery of an object, such as concrete or digital infrastructure and network of cooperation (from obligation to rush to get things done for the benefit of all).

D. <u>Focus toward project completion</u> :

The need of complying with the initially approved time plan was a challenge for all the observed projects, since a lot of time was wasted for initial process of solving the above described A, B and C challenges. Other interferences toward time line completion have been the legal frame agreement, in the case of the H2020 projects, and the initial process of concept definition for the Square project. These elements represented an important deviation in participants' perception of the projects.

All participants committed to initial time-plan and deliverables definitions. In the case of the H2020 projects, the formal contract and the link between deliverables completion and funding stood as a guarantee for the EU and for the internal stakeholder (the hierarchy) that partners would have been exposed to minimal financial risk. Partners embarked the projects thinking that deliverables completion would have implied a smooth and fairly quick merging of technical standards among partners, a top-down acceptance of the project output for external partners and users, and that the value proposition of the ecosystem would have been created by the consortium partners using current processes and with no interaction with further actors in the value network.

All projects had deviation in timing, quality and profitability.

In the EV Charging infrastructure case, the project was intended to deliver a convergence towards a European interoperability of the network to boost sales of EV, the appeal of which directly depended from a charging and payment standard.

In Data Marketplace case, incumbents need a convergence among data collection and processing (enriching, packaging), in order to achieve data package standardization and therefore usability. OEMs attempts to build a business model around car data didn't provide any sustainable result, as the scope of the business model was limited compared to the ROI target on the considerable investments in sensors and cameras for the "connected car".

In the case of the Square project, participants considered that technical standards from vehicle and urban infrastructure would have merged as a consequence of the exploration result in terms of service's needs and structuration.

In reality, partners' initial definition of milestones, mostly compliant with existing processes and previous experience in exploration projects, resulted not adapted to value proposition structuration. Nevertheless, due to partners' internal established processes of financial evaluation of each division, to strategic roadmap including observed projects, the goal must be achieved.

In all cases, allocation of resources was not coherent with the project target achievement, being strictly up-front defined in EC projects and informally defined for the Square project. The number of partners selected at the beginning of each project increased along the way, and such increase generates extra-budget for each project. Projects were somehow structured while developed.

Projects had on one side, to commit toward a specific plan, (EC projects) with defining work packages, milestones, while the third project was driven by a flexible plan driven by a creative experimental process.

In the Square project, the degree of flexibility in time-plan management allowed adjustment needed during the discovery of key issues at stake in the project.

Regulation, first users' feedback and technical standards definition acted as time-plan interfering factors, but they also ease the comprehension of collaboration need toward deviation resolution. Partners understood that the individual business target on each project could only be reached by collaborative actions toward strategic decision-making within the project.

There was another important deviation on the observed projects concerning the target of "business model" sustainability. Each EC funded projects committed to find a self-standing profitability by the end of the project. However, no project could show enough direct customer volume or appeal to support incomes, or show a converging running cost structure. In the case of the Square project, the profitability was part of the list of issues to be addressed by the vision, but there was not a firm target imposed by the leader or by an external actor.

In the three cases, a so-called "business model" was one of the expected results in terms of self-standing profitability by the end of the project development. However, no project could show enough users adoption rate in the business plan time range, and the cost structure was still heavy compared to the users' volume.

Such misunderstanding leads to investment delay on the complementors' side in terms of car data collection equipment.

As far as knowledge management, partners started thinking differently on which knowledge was needed compared to what they thought at the beginning of the project. They realized knowledge from outside the team was necessary. In CorriDoor and Automat it was knowledge from the consortium partners and from other institutions, in Le Square participants knew since the beginning that knowledge from outside would have been key, but they realized that knowledge from inside the company was needed too. All realized that identifying which is the knowledge to integrate takes time, and then integrating it takes another additional time.

E. Awareness of strategic relevance :

Partners constantly evolved in the ambiguity of the direct vs strategic value appreciation of the project.

Partners showed along the way that the projects they were taking part to, had a broader strategic value than the deliverable per se; the insistence on certain aspects of the projects might be the sign of a hidden and earlier awareness of the role such innovation projects could play internally in terms of competences acquisition, internal politics and power games tactics.

Partners' management of such innovation projects was initially driven by the fact that the project is one of the few chances to explore the innovation with an authorized budget, after other initiatives failed within each organization. Participants believe that there are chances to achieve the project goal, but with a limited vision of value creation and capturing will derive from them. Shown awareness of the strategic relevance of the projects was fairly limited at project's kick off.

The management approach to the project of public and private partners was not harmonious, with different management drivers, which results in a lack of coherence among partners' engagement during the first phase of projects. Also the role of public stakeholders external to project teams (i.e. EC and national institutions) was not clear at the beginning of the project, giver and taker at the same time with evolving needs and expectations along the project development. In the case of EC funded project, the public partners were disrupting the process of location selection in CorriDoor project, and in Automat they revised and clarified their expectations on some deliverables while the project was ongoing. In the case of Le Square, the participation of the public partner was impacted by evolving priorities from other divisions and input expected had to be complemented by the intervention of other actors. During the projects development, partners realized that the initially defined value chain was only a partial vision of the value network they should consider while assessing the project as they were contributing the generation of a *proto-ecosystem* based on the connected car (Marcocchia and Maniak, 2018). While assessing strategic decision regarding engagement in such project, some partners realized they had to assess and manage such projects in conjunction with a much larger panel of stakeholders and with other exploration projects, complementary to them and useful to a better positioning of the company in the ecosystem and value network to be.

The delay in project completion with a more diffused awareness of projects strategic value resulted in a stronger engagement toward completion for most of the partners and toward a follow up phase in which the knowledge created in the observed projects could have been used with other partners and for a broader scope. Partners expressed the volunteer of pursuing their cooperation in different forms, as applying together to another EU project call, or as evolving project's endpoint and including more and more partners. Through such actions, organizations enlarge the scope of the collective action from one project to a sequence of cumulative projects or to a larger project conducted together. Knowledge produced in an innovation project is only reused afterwards in a lineage program approach, allowing to over-invest on initial project (Maniak and Midler, 2014; Maylor et al., 2006).

The phase of use's exploration emerged as key in the process of EVP definition, and the collective approach followed by the participants to the Square project was chosen by a shared awareness of user context exploration impact on revenue stream.

F. Target of the project:

The project target was in all three cases submitted to extension process. Partners' awareness of the strategic relevance of considering a wider target matured during the project, as value proposition design progressed and they need to increase the number of stakeholders involved in the process of structuring the ecosystem allowing target achievement. In the AD vision project, the relationship between the team and the headquarters allowed the progressive integration of external partners, with consistent modification of deliverable definition and project mission. The awareness of collaborative development of common standards as a condition sine qua non for value proposition definition was achieved relatively early in the process.

As the technological standards and the value proposition definition took place all along the project and not based on the upfront expectations of participants, partners had to consider deploying several actions along the way in order to achieve exploration targets:

- Deployment of additional resources
- Input of external additional knowledge, often not related to incumbent core business
- Consideration of partners' choice as key to structure the value proposition resulting from the emerging ecosystem.
- Internal acceptance of new technical standard defined in such projects.
- Collection and merging of internal knowledge from different exploration projects
- Awareness and internal acceptance of indirect and/or intangible value created by the ongoing exploration project by considering a larger network of ecosystem participants
- Collective sense-making of the project among project participants and for each project participants, diffusion of such sense within their organization

The target of projects evolved in all the cases, as the ambition related to the projects was reconsidered by partners and the legal frame linked to technology and personal data use evolved during project timeframe. Such evolution of target generates in all cases tensions within the project and internally for each partner, as the project management traditional logic requires managers to fulfill the upfront defined scope of work, and performances of projects and people are defined on the basis of such fulfillment.

G. <u>Ignitition factors to action</u>.

Since the beginning, partners gave as a granted the project development path, a certain degree of knowledge of the other partners, and the active participation of each ones, as generated by the simple fact of signing a contract or stating the participation to an exploration team. But partners discovered that traditional project frames did not apply, that they didn't know each other that well, and that a set of factors were needed to quickly act during the project. Actions of partners was encouraged by factors such as internal alignment, project leadership, individuals' motivations, the perception of the role of the project in profitability derived from innovation, and regulation congruity across countries limiting the territory of innovation deployment.

Partners reciprocal knowledge requires to be deepened in order to build the trust needed to define what to be done together and act toward it. Beyond personal relationship among participants, or business connections among partners, the in-depth alignment of partners emerged as a factor to move projects forward. And each partners needed to involve its internal organization in order to keep contributing effectively to the projects. All projects had great visibility within partners' organizations. The commitment was slowly achieved in H2020 project, which were driven by formal settings such contracts, several deliverables and reporting, defined participants and roles. It was quickly reached on the third project, but the effectiveness of it in action was delayed by the lack of defined object. The level of vagueness of the third project output was greater than the first two.

Furthermore in each project, one actor took the lead, for formal reasons (it was declared in the contract), or as a fact in terms of activities' management and coordination. In each of the three cases we observed one organization taking actions toward project management, partners' involvement, and dialogue with external actors. The platform development results from complex activities orchestration, which requires heavy project management and the concentration of in on a focal firm keeping the actors incent toward milestones respect and deliverable completion, beyond the obstacles the project might encounter.

Individuals' motivations and goals are also relevant to define behaviors and to ignite participants' action. There is a disjunction between what is officially said about the motivations and goals to stimulate action in such projects and the real intentions of participants. It is confirmed by the evolution of the concept, the focus of target completion and the ignition factors to action.

If we take the example of EV sales increase of car data monetization, the short term goal of profitability aligned to core business as selling mainstream cars, such goal is driven by the firm's financial obligation and not by conviction of the team working on related projects. In the Square project this paradox seems solved because of partners spontaneous understanding on the need of offer evolution and of engagement with no profitability immediately realized.

From the cross-effect of the above management challenges, the perception of the role of the project in profitability derived from innovation evolved and played a role in incenting individuals to act. The in-house-project efforts alignment, the focus toward project completion and the awareness of strategic relevance, they all are strictly related as focus toward project completion interplayed with the evolution of relationship between project participants' and internal organization, which contributes to increase the awareness of strategic relevance of the project.

This can be explained by the fact that actors' initial appreciation of the project was based on direct value generation, with no consideration of externalities that the emergence phase of the ecosystem could have generated for each actor. The strategy of investment driven by subsidizing activities with no direct value has been performed by partners seeking the contribution of such activities to the development and future profitability of other activities (as in the case of Google, Amazon platform strategies). In other cases, partners used the project as a springboard to trigger internal conditions for further development of innovation topics within their organizations. Projects are the best compromise solution to perform such internal action.

Another factor appeared to be relevant to partners' action effectiveness, the dis-homogeneity of regulations among the different geographical application perimeters. From the observed field, we noted that regulations might be not homogeneous at EU level among different countries, and in other cases outdated and-or un-applicable, as in the case of the EV infrastructure deployment and Big Data management. Or regulations do not even exist yet, as for the AV deployment in real use cases conditions. Such lack of regulation homogeneity is perceived by actors as potential risk of involvement in additional and unforecastable cost for regulation-non-compliance, in case of the responsibility of technical safety or data protection toward data owners. Such responsibilities are fragmented among private actors and public authorities at national and European level, but they are redefined dynamically by the evolution of the regulation. Incumbents' choices on a proto-ecosystem project proved to impact the regulation definition itself, which should motivate actors to increase their engagement. Nevertheless, the difference in geographical boundaries among projects and the difficult in estimating the future definition and application of applicable regulations, they both reduce visibility in medium-long term effects on compliance cost forecasting. The consequence is that incumbents' action tends to be constraint by such reduced visibility on financial exposure.

5.2.2 The dynamics of the management challenges

Now we show that these challenges did not appear with the same timing and with the same criticality all along the projects. At each step of the projects, we could identify one or a couple of driving forces which were more critical than the others. We illustrate the progression per challenge as the projects evolved over time, in order to show which management challenge defied the projects at a certain time and which the process to overcome it was.

The assessment of such evolution is presented below, complemented with the visualizations of such key management challenges dynamics for each project.

CorriDoor key management challenges dynamics

At the beginning of CorriDoor project, the priority was set on the legal document binding the partners.

The start of the project was originated by an idea presented to the European Commission as a hypothesis of innovation for a trans-national goal of interoperable networked infrastructure. As soon as the project was accepted, every partner had to deal with internal organization in order to defend the interests of the project itself.

Partners' action toward information sharing for service deployment progressed slowly until the contract discussion, negotiation and final signature were completed, and partners' motivation for action was driven by funding and sales concerns.

During contract clause negotiation, the deep contrast in semantic definition emerged. The key concept of the networked European infrastructure CorriDoor needed to comply with was the interoperability, and while discussing the negative legal implications of not reaching it, partners realized they did not associate the same meaning to the word. At the end of the project, all want to achieve interoperability, but which interoperability are we talking about? And which level of it? And is it defined at European level of national definitions need to merge? Based on which technical and user experience standard can we define interoperability?

Such semantic debate ignited the investigation on internal procedures and understanding, which needed to evolve in order to allow the legal clauses to be agreed upon and have the project to move forward. Once the coherence gap was recognized among internal procedures and project needs, the integration of new stakeholders began, as a process of providing external knowledge to agree on the redefinition of concepts.

When the users' expectance and public authority constraint became clearly key factor for project completion and success, partners' action improved toward knowledge sharing. This also opened new space for value leverage from interoperability for each of them.

As agreement on concept definition was achieved, agreement and acceptance of interoperability target and liability responsibilities by the service provider was also completed. At this stage, the typology of networked infrastructure and the individual station became the standard under setting for a wider strategic plan for the service provider and partners, which contributed to strengthened the link between the project and the internal organization of each partner with higher level of commitment.

Although projects costs started to inflate, due to installation and connection costs higher than forecasted, partners widened the target of the project, as it became the standard model for future similar projects and bids, and mentioned by partners as an energy production improvement tool.

From this stage, information sharing increased progressively among partners, fueled by a certain level of collaboration and solidarity on the discovered value of knowledge sharing and common action for flexible project management compared to rigid compliant to pre-determined rules. Pressure from outside, i.e. national public actors and European similar initiatives, propelled the actions toward extended target completion, and enhanced link between project and partners' internal organizations.

In order to follow visually the dynamic path of the impact of the forces during the project, we represented the sequences of links among the forces igniting the strongest reaction among partners.

Table 22 CorriDoor challenge dynamics

KEY MANAGEMENT CHALLENGES	PROPOSAL PREPARATION 2013 to Kick off early 2014	CONTRACT DISCUSSION Early 2014-febr 15	REGULATION CONTRAINTS march-aug 15	PARTNERSHIPS AND USERS FEEDBACK Sept-dec 15
1. Concept sharing	Shallow definition of concept shared-key concept's features not explicit	Semantic debates	Internal and external negotiation on concepts	Internal debates on demand system and expectance. Attempt to shared definition through shared knowledge
2. Information sharing	Minimal	minimal	appreciable	High
3. Relationship project/internal org	Project highly visible at each partners	Incoherence internal procedures on legal debates	high	High
4. Focus toward project completion	Driven by rigid and structured frame of project	Low	High toward offer, low toward users	High toward offer-Medium toward users
5 Awareness of strategic relevance of project	Yes	Yes, but it should not compromise internal compliance rules	Yes in relation toward the risk of EU restrictions on budget and on internal visibility	Yes in relation to simultaneous action in different countries and national authorities pressure
6. Target of the project	Clearly defined by all partners	Unchanged	Enlarged	Confirmed
7. Ignition factors to action	Public funding for infrastructure needed for business sustainability	Completion to internal rules	EU funds preserving	Sales kick off

The semantic debate represented the ignition factor to fuel information sharing, to strengthen the relationship between the project and internal organization at the partner level, and to widen the project target.

Such trajectories for each factor contribute simultaneously to encourage partners' action toward management challenge solution and progressive alignment toward discovered wider target. The contribution of internal organization was key to improve the knowledge sharing as well as the coordination with international initiatives toward a wider strategic impact for each participant.

Automat key management challenges dynamics

As observed in CorriDoor, once European Commission approved the project, all partners were satisfied and formally fully committed to an effective project completion. Nevertheless, since the very first meetings after bid assignment, tensions appeared around concepts definition. Partners described the project to the EC as a « big data » platform derived from homogeneous collection among competitors of the same industry, but it appeared immediately clear that players around the table have less data packages than the ones required by a commonly shared understanding of "big data". Furthermore, they did not have the required internal authorization to share such data and they discovered that data collection was not performed with the same technical definition (histograms vs time series). The data package aggregation and test protocols have also been source of strong debates among partners. The clarification of all the above concepts required a considerable amount of time, and it requested the discovering and sharing of the project vocabulary and ambition. In the meantime, partners realized the existence of the un-coherence between internal processes and project needs. At that point, they turned their actions within their organizations to persuade the decision makers and other divisions (such as legal and sales) that their implication was needed to move the project forward.

The semantic debate on concept opened the path to awareness of the complexity of value proposition definition and on the role of legal and technical constraint on data package creation and use. Information sharing increased progressively as the urgency of finding a viable match between offer an demand is requested by the project, and by partners' internal organizations. Some partners realized the increased strategic relevance of the project for their internal roadmaps, and as sharing information continues among partners resulting in knowledge building and sharing, partners realized that the concepts sharing is an enabler of other innovation projects. The relationship between project and internal organization increased dramatically.

The focus on the project completion increased in the final stage of the project, especially related to the justification of business cases, which was one of the main priorities of the EU. While partners realized that this priority could not be fully satisfied in the time-resource perimeter of the H2020 project, their enlarged the target of the project as it became the first step toward innovation projects with a larger scope in other sectors. The obligation of complying with initial setting of project performance to secure final funding, fueled the actions of all partners to final delivery.

In order to follow visually the dynamic path of the impact of the forces during the project, we represented the sequences of links among the forces igniting the strongest reaction among partners.

Table 23 Automat challenges dynamics

KEY MANAGEMENT CHALLENGES	PROPOSAL PREPARATION TO KICK OFF 2014- APR 2015	TECH FEATURES DEFINITION APR15-OCT15	DEFINING BY DOING ACCEPTANCE NOV15-AUG16	PARTNER CHANGE AND 1ST PROTOTYPE SEPT 16-MARCH17	USE CASE AND DATA AVAILABILITY FOCUS Apr 17-Sept17	INTERPLAY WITH PLATFORM Oct17-Apr 18
1. Concept sharing	Shallow definition of concept shared-key concept's features not explicit	Concepts are explored through different methods (brainstorming sessions, video etc)	Further workshops with artefacts; deep semantic debate starts	Semantic debate on quality and usability	Semantic debate still on going on anonymization. Shared concepts definition achieved	Shared definition of value proposition through shared knowledge achieved
2. Information sharing	Minimal	minimal	Minimal	Increasing for test protocol definition	Increasing for real data collection and packages availability	High since SP can give feedback on offer system
3. Relationship project/internal org	Project highly visible at each partners	No changes	One partner has issue with goal alignment	Some partners detect incoherence btw internal processes and project needs	High	High
4. Focus toward project completion	Driven by rigid and structured frame of project	Low	Low	Low	High toward match finding between offer and demand, and first prototype tech verification	High toward justification of business cases
5 Awareness of strategic relevance of project	Yes	Yes	Yes	Yes, awareness of potential strategic changes enabled by it	Yes for some actors in relation to parallel projects at their HQ	Yes in relation to the risk of EU restrictions on budget and on internal visibility
6. Target of the project	Clearly defined by all partners	unchanged	Unchanged as consortium, signs of extension of interest from some partners	Discussion on what the relevant perimeter should be	Confirmed as per project kick-off	Confirmed for the consortium, but enlarged for some partners
7. Ignition factors to action	Public initiative and funding for competitors joint actions and business sustainability	Sales increase through data packages management through platforms	Business ignition for internal goals on data management strategy	Completion to internal rules of division performance	EU funds preserving	EU funds preserving and knowledge transfer on other internal IoT projects

In Automat project, the semantic debate generated by the discussion on concepts using artefacts, was a driving force to the information sharing increase, as well as the ignition factor for the recognition of incoherence between internal organization processes and actions requested by the project. The progression of such debates allowed also the consolidation of the strategic role of the projects for a longer time frame action for some partners.

Le Square key management challenges dynamics

The project at Le Square was created on the basis of a relatively shared broad meaning of concept, fueled by high external pressures and individual motivations to contribute to the solution to the urban autonomous mobility. Several private and public partners were aware of the resources and investment needs in such a solution discovery path. The need of deepening the shared understanding of the concept appeared at the very early stage of the project. The debate on concept started at the very beginning of the project, managed by the use of design-driven methodologies such as Design Thinking and CK theory derived tools. Such process allowed partners to collect a large knowledge base from several disciplines, and to perform an iterative process of conceptualization and value proposition definition, while enlarging the scope of the project itself. In this project, external pressure to act came strongly also from the public authority, the public partner, which participate actively to the semantic debate during the creative sessions. Nevertheless, the strategic value of the project was found by each partner in the link with other internal projects, as the concretization of the observed one was not fully sustained by the public partner.

While the path to a deeper understanding of the urban autonomous mobility vision was an enabler of team information sharing, collaborative work and focus toward project completion, the need of a more elaborated deliverable emerged, as concrete outputs would have ignite further support and investment from private and public partners.

The target of the project had to be redefined and enlarged to include a physical object and an exploration methodology. Such additional deliverables would have satisfied the goals of several partners and the performances evaluation rules for internal reports on innovation projects. The target of the project had an additional evolution as partners considered the contribution it can provide to similar projects and merge efforts to a multi-lineage project perspective.

Although delayed from its initial time plan, the Square project had delivered concrete elements to move the sensitive and hot subject of urban autonomous mobility further; it kept all partners onboard, even if it pivoted several times.

In order to map the dynamics the forces on the management challenges during the project, we represent below the sequences of links among the forces igniting the strongest reaction among partners.

Table 24 Square challenges dynamics

KEY MANAGE MENT CHALLENGES	INITIAL SETTING TO PROJECT LAUNCH NOV-DEC 2016	THE RELEVANCE OF PERSPECTIVE AND TEAM JAN-FEBR 2017 6	AUGMENTED TARGET MARCH – APRIL 17	DELIVERABLE DEVELOPMENT MAY – SEPT 2017	PROJECT SENSE-MAKING OCT-DEC 2017
1. Concept sharing	Very large definitions, fragmentation of operational achievement. Need of internal and external sharing perceived	No definition of concept, but shared definition of process to get it and expectations	Extended as impact on internal organization becomes clearer. Semantic debate on use cases definition	Semantic debates ongoing among team	Clear sharing and definition of a multilayer structure
2. Information sharing	Very limited	Increased among partners	Increased with internal organizations	Higher at internal level	Higher at external level
3. Relationship project/internal org	Loosen	Loosen	Closer on project communication	Started to become closer as technical standards definition needs to move forward	Stronger in communication, emerging on POC operational steps
4. Focus toward project completion	Dispersed	Driven by individual expectation and personal motivations	Stronger as project target becomes larger	Unchanged	Stronger as project might be coupled with another one
5 Awareness of strategic relevance of project	High	High	High	High	Very high
6. Target of the project	Not defined	Loosely defined in term of vision, already increased on collaborative work	Augmented, as multi-POC strategy is considered	Two additional objects identified	Enlarged as shared with other internal exploration project toward deployment
7. Ignition factors to action	External pressure on subject	Individual motivations, direct positive externalities	Sense-making and awareness of bigger target	Unchanged	Link with other internal project and Positive feedback after communication events

The dynamic path among driving forces shows that in such project the access to a large variety of knowledge base ignited a high level of personal motivation, and the team achieved quickly the strategic conceptualization of multi-project need, with a multi-layer frame for service deployment and value definition. This conceptualization impacted the team action within the project as well as the team relationship with the headquarters. Although technical standard definition for communication between static and moving infrastructure was not reached during the project, all partners realized the double strategic value of the knowledge and network generated by the project, as key contributor to internal innovation roadmap based on service platform deployment.

Cross-projects considerations

If we go beyond the single project and we consider how actions evolved during projects' step, we start noting that all actors started the innovation project in order to strengthen a weak individual position, moving forward initial misunderstandings.

The two H2020 projects have been guided by a formal and legal commitment which brought partners together initially; the Square project has been guided by the necessity of continuously maximizing its value, which involved the need of profoundly modify the final deliverable (from a vision to a physical mock up and a methodology).

The time needed by EC projects partners to shift from the initial common "fuzzy shared vision" to a concrete definition of what had to be done together, was not only a question of personal relationship, but rather on exploring the in-depth alignment of partners, and correlated with each partner specificity in relation with practices of such projects. The formal commitment kept almost everyone (with one exception) incented to go beyond the a priori divergences, and to find ways to go forward. The demanding reporting process requires a strong investment from each partner, empowering each corresponding internal project internally, and requesting to validate this position with various internal divisions. This took a lot of time in each project and contributed to the project initial inertia.

For partners at Le Square project, the representation of the vision was the initial target of the project, and although not detailed at the beginning, it acts as a cohesive element for individual motivations and acceptance of joint collaborative path.

Once this initial "common commitment & trust" are acquired, players discover the real strategic agendas of other partners, they go deep into their technical background, and realize that they also have other partnerships on the same issue. Observations showed that, even with delays in official target completion, partners increased their engagement, with one exception.

Furthermore, motivation to collaborate was triggered by the concretization of the fact that collaboration with competitors and external private and public players to deploy networks was needed to get a real monetization of data and resources management.

The moment in which partners started to collaborate and the degree of collaboration, both vary among the projects, with a slower ignition and moderate degree of it in the first EC project to an initial intention statement and high degree developed during the Square project. The lack of contractual frame for a formal engagement does not prevent partners to engage in a firm participation and active contribution toward a shared target. In ecosystem creation initiatives, it seems that rigid contractual frame and upfront investment are not the only elements fostering partners' collaboration.

As a synthetic overview of the evolutions of partners' choices and actions in ecosystem's structuring, we identified a sequence on which partners all start with a lack of mutual understanding, which evolves through a sense-making process. Such process starts by questioning the meanings of words and concepts, which help actors to explore and to share significance. Participants started to process of "interlanguage" (Lenfle and Söderlund, 2018) development. In this step of the sequence, the internal organizations of each partner are not playing a role, as the project has still a low internal visibility. Project's legitimate role as strategic enabler for ecosystem's structuring and organization's sustainability is not perceived yet.

Once partners achieve language and expressions sharing, they can proceed with the definition of the value proposition. As this process start, partners realized that more stakeholders have influence in the value proposition and in project completion. The value proposition construction of a project is in fact the structuring of an ecosystem. Typology of members and communication among them contribute to the ignition of value proposition design.

Each partner is then motivated to push forward internally the actions needed toward value proposition design achievement, from a technical or business perspective, increasing progressively the information sharing within the project and within its organization.

Partners mature along the way a new set of knowledge, on the specific projects and on other internal projects, which increase the sense-making of the completion of the project itself.

Based on the above, the explanations of the evolutions of the challenges are related actions are convergent on the three projects, and drove the emergence of a common path.

5.2.3 Ecosystem innovation project management: a 4-step process

Once the data analysis completed, we had been able the process of management of an ecosystem related project emerged inductively. Such project has several peculiarities compared to a standard innovation project, as it is conceived to deliver two simultaneous results, a commercial result on innovation deployment, and an exploration results, treating unknown subjects. We propose to name such exploratory ecosystem related projects as « Proto-ecosystem projects » (Marcocchia and Maniak, 2018).

On the basis of the dynamics of management challenges, and on the identification of the driving forces influencing such dynamics through participants' actions, and beyond the diversities among the projects, we decoded four sequential phases of incumbents' action to systemic and disruptive innovation exploration, contributing to structuring the mobility ecosystem. It seems that systemic project begin with an internal failure. People are in charge of a topic / project which goes far beyond the core business of the company. So they try to find allies. They finally find allies relying on a common set of languages: big data, interoperability, smart city… These words find echo in some organizations which also feel puzzled about these topics, and feel they cannot do this alone.

In the first phase, once the project has been approved or launched, here begins the ”proto-ecosystem project”. We identified that a key management issue at the beginning was to face the fuzzy concepts which were a priori the reason for a common project. It takes times and struggles to go beyond the diversity of interpretations of these words, and to figure out what a common value proposition can come out beyond the initial misunderstandings. Through the definition and sharing of the concepts structuring the value proposition, partners realize and accept the need of collaboration to build common standards and users' acceptance.

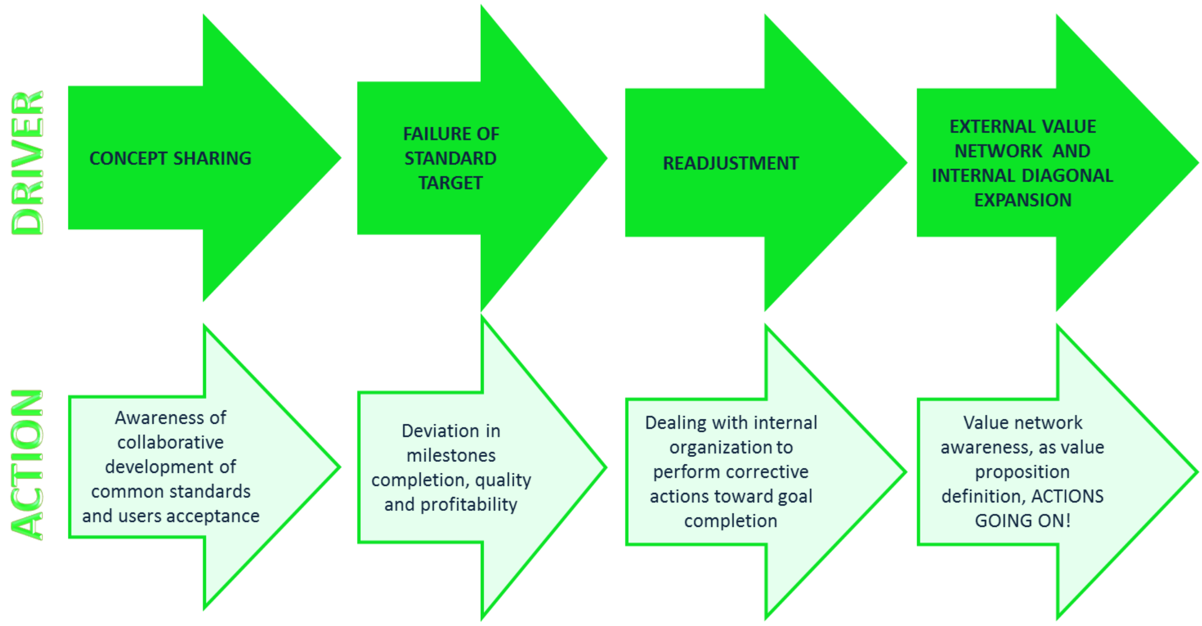
In the second phase, once a certain level of collaboration is reached, partners face the apparently inevitable failure of the project compared to pre-established project management standards of performance measurement. Time completion, quality and profitability need to be revisited and project performance to evolve to match the under-construction value net generated by the project.

In the third phase, the question of internal fit and engagement emerges. The project was born with a specific team, located in a specific service/business unit of each company, but to make the common proto-ecosystem project moving forward requires adding internal resources onboard and having formal in-house clearances. The need to comply with project milestones and initial commitments incents every participating organization to overcome internal reluctances, and progressively conquer in-house legitimacy, budgets and agenda. Partners deal with internal organizations in order to introduce process, evaluation or structure changes in order to allow the project deliverable to be achieved.

In the fourth phase, as value proposition definition is collaboratively developed by partners, and the links with the internal organization deeply explored and in some cases re-designed, the project undergoes to a phase of diagonal expansion. Such direction of expansion is defined in terms of setting the base for assets creation outside the directly related internal and external environment. We move to an expanded network within the organizations partners belong to, and to a wider external context or relationships, driven by the involvement of partners from different sectors or internal division not directly related to the project.

The four phases and the actions partners perform at each stage are shown in the below figure:

Figure 67 Ecosystem innovation project management 4-Step process



The opportunity to take part to the structuring of an ecosystem relies on the acceptance of cognitive "destabilization" at the beginning, coupled with an "administrative" destabilization originated by the failure in achieving set targets. The readjustment is mandatory, and it happens at two levels, project and headquarter. Actions undertaken allow the value proposition definition to move forward concretization. Partners discover interest of the headquarters for cross-pollination of related projects, and realize that a mutual alignment with some partners is strategically desirable based on and beyond current project.

The value created in such process can be measured also in the possibility of diagonal expansion based on the knowledge and the network in terms of interactions and transactions firms built during the project and strictly related to the project. Here the proto-eco-systemic project are the mediating variable to have a firm (independent variable) influencing an ecosystem structuring (dependent variable). The diagonal expansion opportunity did not exist before embarking in the project. So the proto-eco-systemic project has an expansive role.

5.2.4 The moderating role of project management settings and partners' alignment

The literature review elucidates the evolution of innovation performance indicators related to the sustainable competitive advantage achievement and the mediating variables influencing such performance.

Innovation performances in the context of ecosystem structuring are set in the literature as Network value creation and collection, business model evolution, and absorptive capacity generation. We noted that although firms express the strategic need to approach ecosystem projects, they keep demanding projects to perform at a firm level, with firm-related performance indicators, such as Quality/Cost/Delay and Assets building.

As stated in Chapter 3, Methodology, we selected to observe the mediating variables as processes as prism of analysis of partners path toward ecosystem project performance.

The mediating variable as processes identified in the literature review are:

- Project management
- Actors' alignment
- Knowledge Management as dynamic capability

We observed that partners in ecosystem projects based on systemic and disruptive innovation do not perform alignment with the same timing, but they follow a similar path. Differences in project management settings as well as in conflict resolution and knowledge management as part of the exploration management techniques deserve to be assessed in order to understand their impact in such difference in timing.

In the next two sub-paragraphs, we describe the result of the analysis of the two mediating variables linked to project management, i.e. project management settings and partners' alignment, and in the next chapter focused on strategy issues, we will present the assessment of the knowledge management as dynamic capability building.

<u>Project Management settings</u>

Project management initial settings appeared to be not adequate to the effective development of the project and not supporting the emerging needs of partners. As partners' level of awareness and understanding of project implications increased during the projects, some setting evolved accordingly, as it appears from the table below:

Table 25 Project Management settings evolution

Project management settings	EV Fast Charging infrastructure	Data Marketplace prototype	Autonomous Driving vision
Reporting			
at project start	contractual reporting, at fixed dates for project status and deliverables, following EC request	contractual reporting, at fixed dates for project status and deliverables, following EC request	no official reporting, fixed date for the project deliverable, no interim reports
at project end/at present	no modifications in reporting tools, deliverables and interim reports sometimes delivered later than original plan	no modifications in reporting tools, deliverables and interim reports often delivered later than original plan	no official report introduced, deliverable date delayed by 2 months
Timeline			
at project start	part of the consortium agreement and approved by EC	part of the consortium agreement and approved by EC	defined by partners involved
at project end/at present	no modification, but goal not achieved on time	modification under discussion, and modification to some deliverables	modified by partners involved
Governance			
at project start	project leadership by public institution	project leadership by private firm with input from other private partners	collaborative contribution by partners
at project end/at present	project leader with strong implication of partners	project leader with strong implication of partners	automaker and tier1supplier
Participation			
at project start	mandatory attendance at fixed dates	mandatory attendance at fixed dates	upon players' interest and availability
at project end/at present	compliant with contract requirement, few partners active in debate	exceeding contract requirement in term of presence. Participation in debate increased, in some cases with relevant inputs	increasing along the development, with deeper level of participation in debate

In the EC funded projects, the reporting is defined upfront, and it is maintained formally unchanged during the project, although the completion of it is often delayed. In the Square there is no reporting obligation and project is delayed as well. The timeline is in the three cases established before or at project kick-off, but during the project development it appears to all participants as not adapted.

Depending on the project, we observed a different degree of acceptance of it and management of the consequent impact on project goal completion. From the first EC funded project, to the Square project, the awareness of timeline-target misalignment had occurred at earlier stages of the project, resulting in an increased acceptance degree. The typologies of governance are different among the projects, and we observed an increased implication of partners in all projects, although at different degrees. Governance seems to evolve from two extremes to a middle ground of few players, who have all very strong links between project results and internal roadmap development. We noted that in all projects settings, flexibility appeared as needed "tuner.

Actors' alignment

As stated in the methodology, we decided to assess the alignment conditions and dynamics of partners through the analysis of challenges the partners' network experiences and the role of artefacts as management tools toward partners' collaboration and alignment.

a. Network challenges

As projects were based on a network of actors and during the development, actors experiences different levels of conflict solvable at a multi-organizational level, we decided to assess the network members progression based on the characteristics identified as relevant to conflict management. Based on the list of challenges a network faces (O'Leary and Bingham, 2007a), we analyzed the evolution of parameters influencing the successful management of the challenges from the perspective of the network the projects created. Such network challenges measure can be the indicator of the alignment performance the partners can reach. The analysis is reported in the following table:

Table 26 Challenges evaluation of networks at the core of the projects

Members characteristics	EV Fast Charging infrastructure	Data Marketplace prototype	Autonomous Driving vision
Interests			
at the beginning	all partners join with individual interest to be achieved by linear interactions of one-to-one discussion service supplier-OEM	all partners join with individual interest to be achieved by simple supply/buy relationship	members participate with individual interest to be achieved by networked interactions of collaborative debate
at the end/current status	few partners realized a wider range of interests could be achieved through the project, but only through collaboration	some partners realized a wider range of interests could be achieved through the project, one service provider doesn't and quit the project	awareness of the need of wider scope of the projects for more individual interests to be pursued
Missions			
at the beginning	defined for all the partners, divergent in some cases because of competition	defined for all the partners, divergent in some cases because of competition	defined and convergent
at the end/current status	unchanged even with evidence from the project suggestes in some cases the need of evolution	unchanged with the exception of one partner.	unchanged
Organization culture			
at the beginning	different	homogeneous	different
at the end/current status	unchanged	unchanged	unchanged
Methods of operations			
at the beginning	different	homogeneous	different
at the end/current status	with changes for some partners	with changes for some partners	with potentiality of changes for some partners
Power degree			
at the beginning	homogeneous	different	different
at the end/current status	unchanged	changed for some partners	unchanged
Stakeholders groups and funding			
at the beginning	different among members	homogeneous among members	highly different among members
at the end/current status	changed	changed	unchanged
Multiplicity of sub-issues			
at the beginning	moderate high	high	very high
at the end/current status	increased	increased	increased
Multiplicity of decision-making forums			.
at the beginning	moderate high	high	very high
at the end/current status	increased	increased	unchanged
Members' Interpersonal relationship			
at the beginning	formal	formal	unformal
at the end/current status	formal, with some one-to-one softening as exception	increased relevance of soft-skills, mix degree of formality and unformality	positively impact by project development
Governance rules			
at the beginning	formally established and hierarchical	formally established and hierarchical	un-formally established and collaborative
at the end/current status	respected	challenged	respected
Relationship with public (citizens)			
at the beginning	low in term of service use	high in term of data generation, low in term of data use	very high in term of service use and impact on daily life
at the end/current status	increased	unchanged	unchanged

The table shows that network members' interest awareness and coherence with project goal is not always clear at the kick off for all the participants, and it can be tested during the development. While awareness and coherence become clearer, the more relevance the collaboration among partners acquires. During the project, the methods of operation of some project partners and their power degree changed, with the introduction of new processes and the shift of business unit relevance. The new processes introduction happened for the more traditionally managed partners, while the shift of business unit relevance has been reported for the more dynamic partner in one project.

Besides, the composition of stakeholder groups, the number of sub-issues and decision-making forums to consider for project target changed for the EC funded and upfront formally set projects, while the high degree of flexibility early applied in the Square allowed the very early consideration of such network complexity.

Conflict resolution appeared therefore driven by interests evolution and alignment, the multiplicity of decision-making forum, the evolution (softening, deepening) of interpersonal relationships among members. Formally established governance rules appear to negatively impact the conflict resolution, if the driver is not a concrete result to be achieved in a short time horizon. An important element that emerged from our analysis is that the initial step suggested by literature for conflict solving, i.e. the identification of network members, which agreement is necessary (O'Leary and Bingham, 2007b) , was not performable at the beginning of the observed projects, as in all cases the complete list of such members was defined along the way, and often included public actors which interests and drivers were not coherent with private partners.

As described in Chapter 5.2.2, all projects deviated from initial targets, all reaching a certain degree of collaboration, but they did so at different moments and at different degrees. It appeared that, as they are developed by a different mix of partners, projects performed differently in addressing network challenges. The projects with a larger number of partners already mature on previously acquired experience diffusion reacted more rapidly and efficiently to solve the paradox of project request and operational actions toward target achievement. Some projects required a period devoted to technical standards, which was helpful in identifying the strategic impact of standards on project business target achievement, and therefore in engagement building process.

b. Artefacts as alignment tool

As stated in the methodology, we decided to create and to observe the use and impact of artefacts as management practice as tools toward partners alignment. Traditional artefacts, such as business plans and more contemporary well established tool as business model canvas, had been deployed during the participation to the projects, but in no cases they were helpful in understanding when and where the value is created and collected.

Through the value chain analysis process, we could observe and participate to the mitigation of the reticence of individuals in information sharing and business analysis format evolution from traditional tools.

In the case of systemic and disruptive innovation at the core of ecosystems structuring, individuals are requested to do a trade-off between existing knowledge and novelty in a collective space, when this collective space is characterized by very unstable factors (including space, time and participants, massive technological novelty and complexity.). And then the distance between existing knowledge from the novelty has also to be considered when discussing the trade-off performance. Taking the decision of performing the trade-off is quite difficult. Probably not a linear, but an iterative process, requiring a new series of multiple boundary objects to perform such trade-off. In such situation of uncertainty, we observed that actors are missing references as far as objects, meanings, perimeters, and on interactions among different technologies. The projects toward which an ecosystem might emerge, they need to build their credibility among actors and for stakeholders. We observed that such credibility is built through collaboration of the actors defining the value proposition. There is the need of structuring a reciprocal trust, among partners and between partners and the platform. The trust path is then built thought steps, it happens within a context, in order to anticipate a reaction and establish a loyal relationship with the others. We observed that, although goals are initially shared among participants, reciprocal understanding is missing among them.

During the research action process, we acknowledged the need of design visual representation, schemas, and format in order to implementing coordination while acting, as emphasized by the literature on intermediate boundary objects.

The research question related to artefacts was then more specifically detailed as: which typology of artefacts was the most adapted to the innovation management situation in order to allow participants to the proto-ecosystem emergence to perform the knowledge trade-off and cooperate? We proceeded by a progressive introduction of different artefacts as driving objects for partners' alignment, which are presented in the figures here below:

Table 27 Timing of the use of artefacts per project- CorriDoor

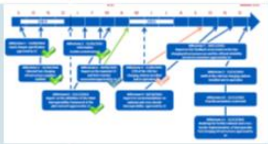
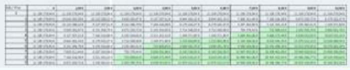
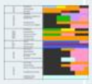
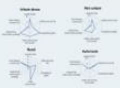
DRIVING TOOLS	PROPOSAL PREPARATION 2013 to Kick off early 2014	CONTRACT DISCUSSION Early 2014- febr 15	REGULATION CONTRAINTS march-aug 15	PARTNERSHIPS AND USERS FEEDBACK Sept-dec 15
Project plan				
Infrastructure map				
Activities flow				
Stakeholders negotiation status				
Operational indicators				
P&L simulation				
Value matrix				
Ecosystem visualization				
Value footprint per station				
Value Chain dynamics			 	
Value network				
Cost sharing – value depending on location				
Business Model comparative frame				

Table 28 Timing of the use of artefacts per project- Automat

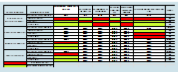
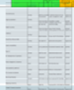
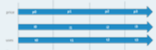
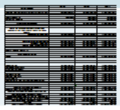
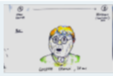
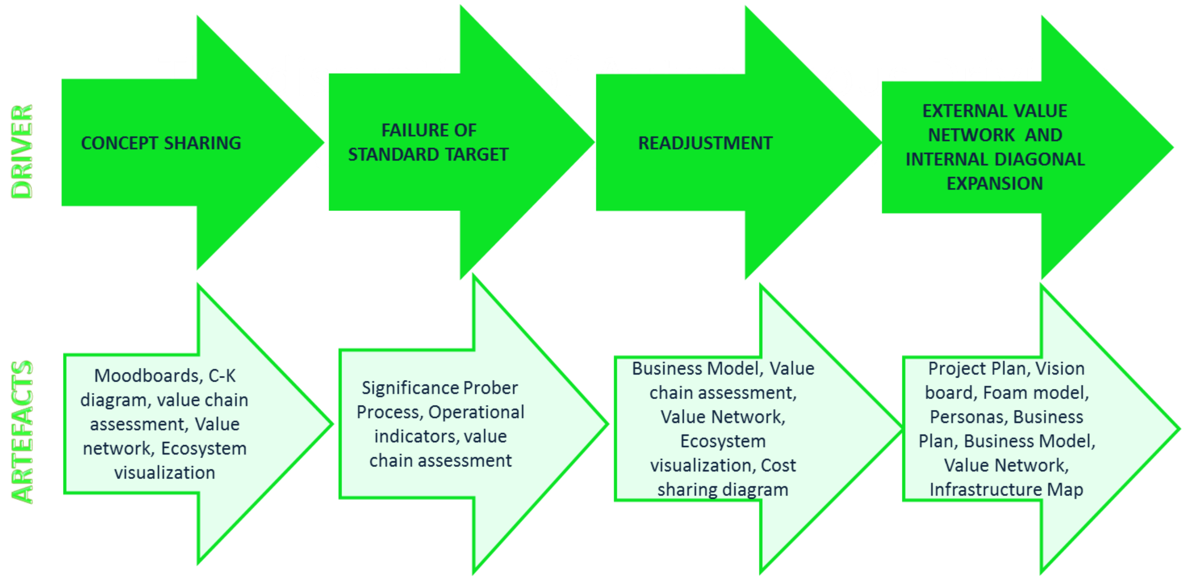
DRIVING TOOLS	PROPOSAL PREPARATION TO KICK OFF 2014- APR 2015	TECH FEATURES DEFINITION APR15-AUG16	PARTNER CHANGE AND 1ST PROTOTYPE SEPT 16-MARCH17	USE CASE AND DATA AVAILABILITY FOCUS Apr 17-Sept17	INTERPLAY WITH PLATFORM Oct17-Apr 18
1. Project plan					
2. Activities flow					
3. Value chain assessment					
4. Data package investigation					
5. Ecosystem visualization					
6. Value Network					
7. Significance Prober Process					
8. P&L simulation					

Table 29 Timing of the use of artefacts per project- Le Square

DRIVING TOOLS	INITIAL SETTING TO PROJECT LAUNCH NOV-DEC 2016	THE RELEVANCE OF PERSPECTIVE AND TEAM JAN-FEBR 2017 6	AUGMENTED TARGET MARCH – APRIL 17	DELIVERABLE DEVELOPMENT MAY – SEPT 2017	PROJECT SENSE-MAKING OCT-DEC 2017
1. Moodboards					
2. C-K Diagram					
3. Business Model Canvas					
4. Persona					
5. Value Network					
6. Vision board					
7. Foam Model					

We assessed the introduction and use of the artefacts based on each project beyond the narrative structure emerged from the data analysis. Based on the identified 4-phase process of ecosystem project, and as per the typologies of artefacts emerging from the literature review on their cognitive performance reported in Chapter 2.4.2.2, we performed the analysis of the artefacts use described in Chapter 3 in order to understand which artefacts are more performant in the specific situation of ecosystem project to mobilize actors toward collaboration. First, we assessed the artefact introduction per each phase of the 4-phase process. We found that depending on the project, a same artefact can be introduced at different time, and some of them are kept under development until the expansion phase. Traditional management artefact such as project plan, infrastructure map and activities flow are the only ones used during project definition before project kick-off. The introduction related to each phase is visualized in the following figure:

Figure 68 Artefacts introduction related to 4-step ecosystem project process



Tools were introduced depending on the "gap" to be bridged among participants, and they were conceived to be acceptable from a traditional business practitioner point of view. In order to be effective, artefacts must stimulate the interaction between users and complementors, as both have to explore the unknown together and develop a certain level of cooperation. Graphically "open" artefacts are more likely to generate a sincere debate, with unpredictable discoveries, but they might not be enough in order to structure a realistic and viable follow up with precise actions. A traditionally framed artefact, such as a project plan and business plan with a price scheme based on users' active participation to platform scaling, appeared to be more performant in keeping partners' focused on innovation deployment.

The most critical nexus of such ecosystem projects is to solve the « knowledge distance » among partners, distance characterized also by differences in terms of culture, time perspective. Such solution is needed for partners to project themselves on a common desirable business future, defendable internally by each organization participating to it.
In order to answer the research question on the most effective typology of artefacts toward actors' coordination and mobilization, we applied the same analysis methodology identified for the « management challenge path »: we identified the artefacts used in each project based on their typology and associated their use to the timing utilization and the knowledge gap they filled. Such analysis allowed us to elucidate the fact that the structuration of a new eco-systemic offer implies

that actors create a vision, a value proposition, a business model which are different from what exists in each participating organization, and that in order to this, partners have to learn to project themselves into a desirable future and to integrate and transform knowledge on users and platform complementors. Some artefacts hardly fit in only one typology associated to a function, as some of them contribute to the process of collective sense-making by starting as enabler of design space and then contribute to provide a common language and strengthening the relationship articulation. The distributed decision-making is achievable through a progressive mix of artefacts delivering coherence through knowledge representation and validation, resulting in the complex configuration of arrangements not known at the beginning of the project. This is the case of C-K diagram, value network representation and Significance Prober process application. Prototypes such as the foam model are necessary to mediate among actors and they contribute to the collective representation of a desirable future as well as to the distributed decision making.

The Business model representation became meaningful between the Readjustment and the Diagonal expansion phases, when new knowledge, interdependencies dynamics and enhanced interaction with users and complementors of the platform provides elements for the value proposition definition.

In an organizational context, the result of the use of above artefacts (C-K diagram, Value Network, Significance Prober Process, and Business Model,) contributes to collective functioning, as they are a means toward unknown exploration and support toward change in organization operations.

Initially introduced traditional project management artefacts, such as Project Plan, Business Plan, visualization of targeted deliverables, are helpful in reassuring partners on the profitability of collective activity. They are initially perceived as the backbone of the ecosystem project. They reassure at project definition and for decision making on embark the project, and they become useful at the 4th phase, when the value of the eco-systemic platform is collectively understood. The traditional artefacts can then reassure internally and externally about the punctual viability of the projects, while partners understand that such artefacts are not the backbone of such project, but useful for internal and external validation.

The result of such assessment on artefacts use and knowledge gap is presented below:

Table 30 Typology and performances of artefacts

KNOWLEDGE DISTANCE TO BE FILLED	ARTEFACT INTRODUCED	WHEN	RESULTS
Representation of desirable future	Moodboard, C-K diagram, vision board, infrastructure map, ecosystem visualization, business model	In concept sharing phase, as well as in the re-adjustment diagonal expansion phase	To be projected together toward a desirable future
Perception and definition of "interessement" of users and complementors	Value network, value chain, Significance prober process, Prototype, Foam model	In all phases	Interaction stimulation among platform participants
Perception and definition of profitability	Infrastructure Map, Business plan, Project plan, Activities flow, Operational indicators, Cost sharing diagram	At project definition, during internal-realignment and diagonal expansion	To reassure partners on profitability of project and efficacy and value of collective action

Artefacts design and management is therefore a key activity in the process of ecosystem structuring, as they are convey collective action coherence all along the process of unknown exploration and value proposition definition. As a same artefacts can have different role as design space enabler, collective sense-making conveyor and interaction enabler with users, and from observed projects, they are not always used with the same timing in the process, the design and use of them should results in a specific "formula" that need to have flexibility margins, in order to be readjusted depending on process development.

5.3 Strategy issues on structuring ecosystem

From data analysis, we observed that nascent ecosystem might emerge in a scattered style, with no declared intention at a so-declared kick-off moment, but through the initially dispersed actions of heterogeneous partners in innovative projects. Such projects foster the development of knowledge and alignment needed to move forward systemic and disruptive innovation exploration and deployment, without being the single cause of innovation deployment. We identified a specific typology of project allowing such initially fuzzy and chaotic actions to later converge in a wider strategic scope of ecosystem structuring. From the single organization point of view, the participation to an emerging ecosystem might be one component of a longer term innovation strategy. We analyzed the contribution of them to the absorptive capacity of the partners, resulting in a contribution to the strategic value of such project for every actor taking part to them.

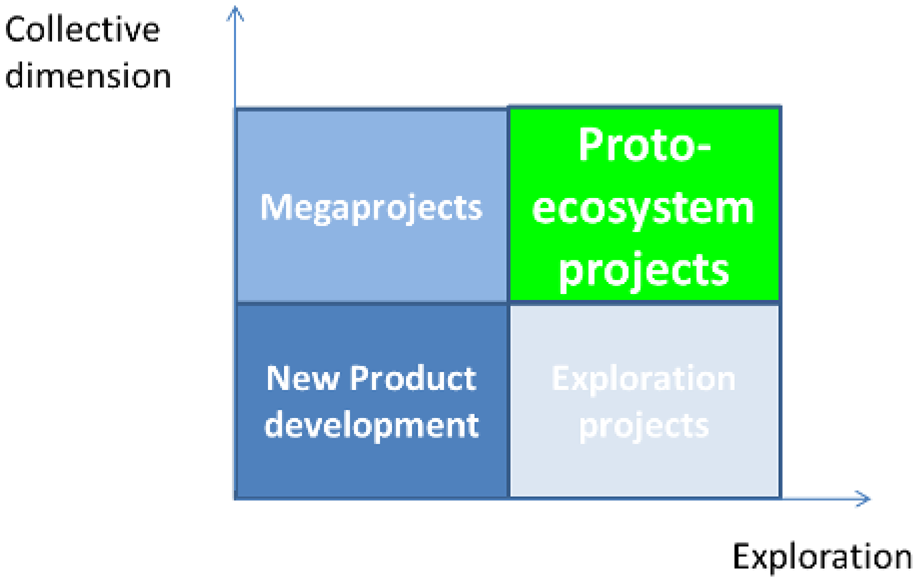
5.3.1 Proto-ecosystem projects characteristics

From the observation of the three cases, it appears that through the development of the projects, actors are defining the elements toward the structuring of a new ecosystem. The evolution partners accomplished of their reciprocal interactions and of their internal strategic roadmap led us to the identification of these projects completion as a very early step of ecosystem's structure definition in systemic and disruptive innovation deployment. We called this intermediate phase a "proto-ecosystem" (Marcocchia and Maniak, 2018).

In our case studies, interaction building by the key actor towards stakeholder engagement (Donada and Fournier, 2014) can be extended to initial participants to a proto-ecosystem towards alignment of different actors and socio-technical shift, anticipating an obstacle to disruptive innovation (Walrave et al., 2017). We observed that such a "*proto-ecosystem*" phase allows the progressive and collaborative definition of partners' interests, roles, interactions, transactions and all the structural elements the ecosystem needs for functioning, while building an acceptance around itself.
The proto-ecosystem project is an overall definition for exploration projects in which innovation is observed at different stages of its progress, from design to deployment. The design situation such projects are facing is characterized by high level of uncertainty in the users' need definition and in the corresponding technical solution. In such project, a certain level of experimentation and test is allowed, as we are in the exploration project arena.
From a strategic point of view, nascent ecosystem might be characterized by steps of alignment building on which the typology of projects is characterized by a high degree of collective action and of exploration. We can therefore fill a gap identified through the literature review, as shown in the

table below:

Figure 69 Proto-ecosystem projects, the missing tessera



Such early step in ecosystem structuring has implication for the ecosystem itself and for the organizations participating to it.

For the holistic framing of ecosystem structuring, it appeared that the process of getting a structure is initially chaotic, as enabled by different initiatives by heterogeneous actors. Such initiatives might happen at different times, based on the knowledge and network of relationship progressively built by partners. From the literature review, the deployment of a systemic disruptive innovation appeared to be possible only through the structuring of the ecosystem. The ecosystem allows the exploration, the development and the deployment of innovation depending on the pace of innovation maturation. In the observed cases, we noted that the two dynamics might not be linked in a synchronized mode, as the participation to an ecosystem might be only a step on the innovation strategy of an organization.

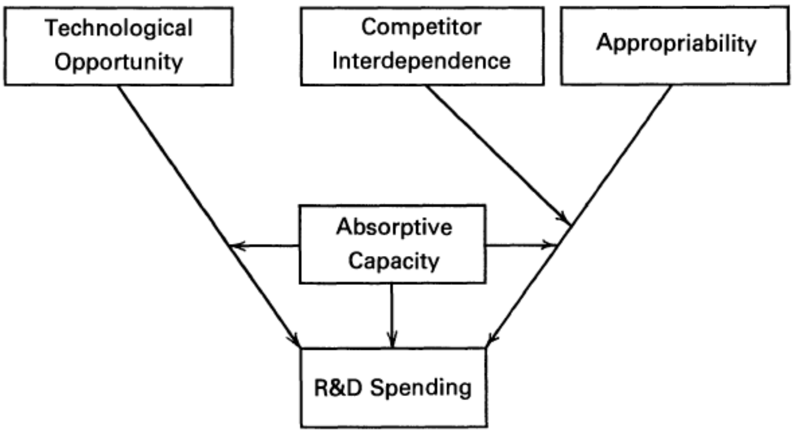
Organizations might participate to the ecosystem structuring phase not for being an ecosystem actor in the future, but as a step in its innovation strategy. Organizations' goal might differ from the ecosystem final structure establishment, as they might decide to modify the partners they work with to follow an internal strategic path linked to a progressive discovery of innovation priorities and targets on a multi-project perspective.

As during the proto-ecosystem phase, participants explore together the unknown, they might recognize their participation to a proto-ecosystem as the opportunity to access a learning space for partners, but also a space from which input are given to motivate internal action at headquarter level. The proto-ecosystem phase might be a step of a global learning strategy. Such opportunities created by the proto-ecosystem do not require that partners initially involved keep their activities linked in the future. Proto-ecosystems appear to create a more flexible space than strategic alliances, acquisitions, mergers etc, as partnership choices for innovation strategy pursuit.

We fill the gap by the identification of such innovation projects as one component of a global strategy of learning. And on this angle, it will allow us to move forward compare to Cohen-Levinthan investment model, as organizations' investment in proto-ecosystem project might result in learning from competitors without the need of investing in spill-over. Furthermore, organizations incentives to investment in R&D for increasing learning capacity should be analyzed considering that investment decision might not come from explicit, rational calculation (Cohen and Levinthal, 1994), as organizations progressively learn that the acquisition of the needed expertise is done by collaborative exploration with no upfront available explicit calculation.

As per the model proposed in the literature and shown here below, it appears that appropriability is related to competitor interdependence, and that technological opportunities are coming as "external object".

Figure 70 Model of R&D incentives linked to absorptive capacity



Source: (Cohen and Levinthal, 1990)

In the case of proto-ecosystem, the technological opportunity and appropriability are co-built by actors. Network interfaces should be considered as incentive to R&D spending decision making.

Literature addressed the emergence of proto-objects as loci for collaboration and action deployment. The focus in proto-institutions, is on inter-organizational relationship and the focus of proto-epistemic of expert is related to several actors in the same sector, or individuals in one organization, but in the proto-ecosystem, we have inter-organizational, inter-sector collaboration (among industries), and inter-boundaries (beyond national level), and inter-economies (public and private). We can define as well the proto- location as diffused along different spatial dimensions.

Based on the project management literature review and on the above elements of assessment on field observations, we can now situate Proto-ecosystems projects compared to literature on project management.

Table 31 Projects and their management features

	Newproduct development	**Internal exploration project**	**Co-development**	**Proto-ecosystems**
References in literature	Cooper Klenschmidt (1987) Thomke Fujimoto (2000)	Lenfle (2008)	Chersrbough Schwartz (2007), Cabigiosu et al (2013)Zirpoli (2002) Maniak Midler 2008	Marcocchia Maniak (2018)
Boundaries (sectors)	fixed	fixed	fixed	expanding
Project briefing	dominanf design driven, market defined	dominant design driven, technical solutions and users uncertain, offer and demand within core business	dominant design influenced, offer and demand defined	no dominant design, offer and demand not defined
Coordination	based on costs, timeplan and performances on sales projections	based on costs, timeplan, project follow up on direct performances	based on partners' internal integration level, knowledge, strategy, and project cost, timeplan and learning. limited to project scope and product-lines derived from it	based on strategic alignment of partners on project goals
Incentives	defined in advance: senior management recognition, financial performance on profitability, opportunity windows, market share increase	defined in advance: customer knowledge, technical knowledge, new business opportunities	defined in advance: cost reduction, profitability of common offer, quicker time to market, business model innovation, increase return on internal R&D	defined in advance: EU funding as contribute to internal R&D budget. Discovered during the projects: knowledge and capabilities acquisition, network experience
Widht of impact of findings	within company	within company	within the industrial sector	beyond industrial sector, involving public institutions and beyond national boundaries

From the literature review on innovation management and ecosystems, the dynamics of ecosystem and the innovation development to market phase seem to be synchronized. The stabilized path seems to be the development of the offer is achieved through by the ecosystem following the path of innovation maturity behind the value proposition definition. The literature on emerging

ecosystems so far considers organizations structuring an ecosystem as focus of the core business, with intent of making their presence in the ecosystem a long term commitment to that ecosystem and a defined industry. But the research developed shows that literature is not covering a case that exists in current systemic and disruptive innovation. In such case, organizations might decide to take part to the emergence of an ecosystem in an industry (even with blurred boundaries) as a step in a wider coverage innovation strategy, involving larger sectors and more partners, for a strategic long term positioning in value capturing positions.
Therefore, the failure of an ecosystem might be not negative if the emergence phase of it allowed participants to progress on two aspects of the organization management:

- From a strategy perspective, if it allowed to progressively cover the lack of balance between the initial understanding of direct value of ecosystem generation participation and its strategic value, which is defined during proto-ecosystem project. This maturity in value appreciation results from the progressive refocuses on offer analysis, the awareness of competences generation and evolution of internal organizations and roadmaps.
- From an innovation management perspective, if organizations are able to free internal strategy formulation from dominant-design-related processes and routines, which represents an obstacle to the innovation exploration and deployment. Such "deliverer" process will involve the evolution of internal processes of innovation project management resulting in an enlarged or reshaped product portfolio for more effective matching with users' needs.

This is already the case for two partners of Automat project, one in the Square and might be the case soon for other partners.
A proto-ecosystem might also be characterized as a space for training and for providing with incentives an organization, without committing for a long term partnership with the other actors participating to the ecosystem structuring.
This seems the case of some OEMs which a year after the end of CorriDoor project, they created a new company (Ionity) with actors not involved in CorriDoor in the aim of leveraging the knowledge acquired during the project on charging infrastructure deployment and contributing to the scaling of EV adoption. The knowledge created through CorriDoor was relevant not only to the connection between the vehicle and the charging station, but also relevant to the attention to user experience through design language and service design, the definition of stations size (multiple charging stations per each location), the users' recognition of location, the identification of the stations on the roads, the management of partnership with location manager as core element of the

strategy of service deployment.

Proto-ecosystem projects classification

Looking at the observed cases, we identified two dimensions to perform a segmentation of sub-typologies, based on the factors to which organizations are confronted to: interactions with headquarters and project framing. Based on the observations of the case studies, specific dimensions appeared relevant to the evaluation of the project characteristics.

As far as the first dimension is concerned, interactions performance can be related to the following criteria:

- Distance to top management (depending on the visibility the department working on the project has compared to headquarter),
- Typology of coordination (bottom up of top down, related also to the distance to top management),
- Integration of partners and its business unit into operational activities,
- Networking capacity within organization toward other Business Units, in terms of other BU actors' engagements, and transversal team support.

The evaluation has been determined on the close/far and yes/no qualitative appreciation, as illustrated in the frame presented below.

Table 32 Interaction with headquarter assessment

CRITERIA	CLOSE	FAR
Distance from Top management	Close	Far
Typology of coordination	Top-down	Bottom up
Integration of partners into operational activities	YES	NO
Other BU involvement	YES	NO

As far as the second dimension is concerned, project framing appeared meaningfully related to the following criteria:

- Timing flexibility (defined ex ante, but flexible or not),
- Deliverable definition (defined ex ante, but flexible or not),
- Reporting (depending on the actors' interest, or stabilized reporting),
- Typology and number of partners (defined ex ante or not and flexible or not),
- Conception management tools (traditional or design theories or practices driven),
- Governance.

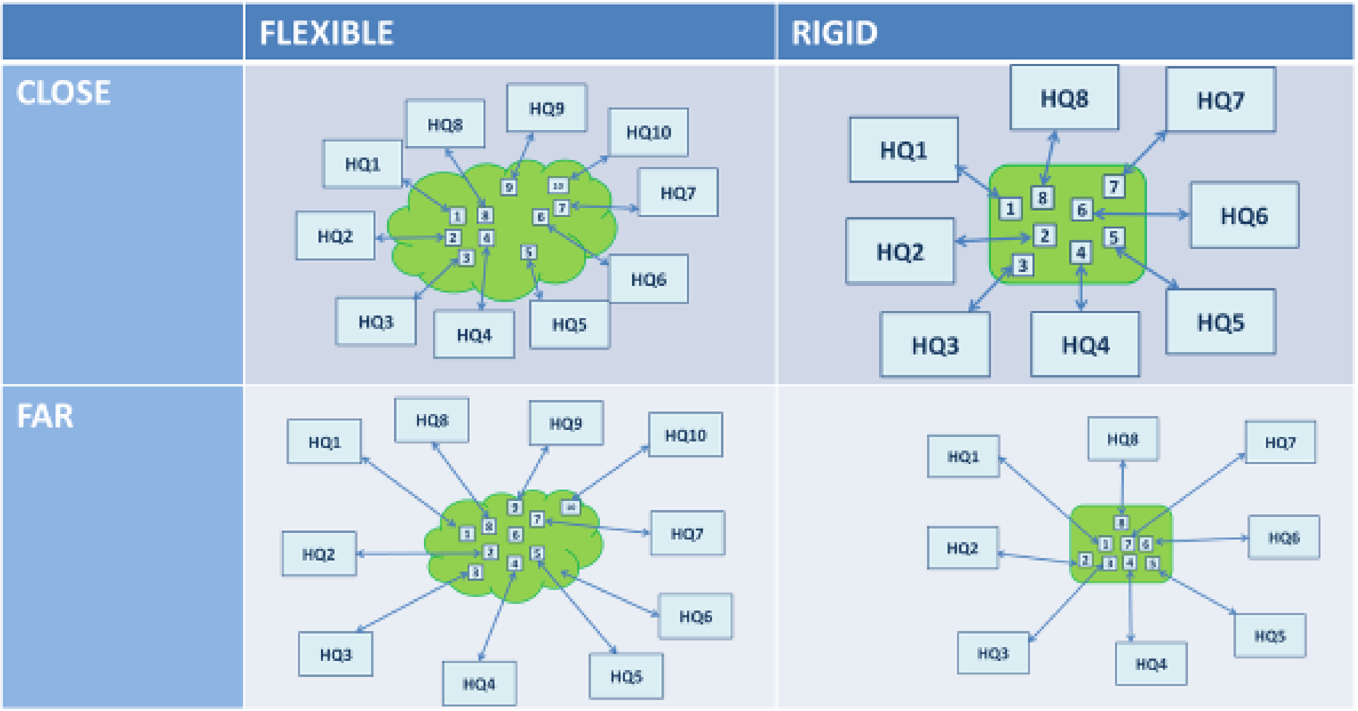
The evaluation has been determined on flexible (defined ex ante or not and changeable) and rigid (defined ex ante and not changeable), as illustrated in the frame presented here below.

Table 33 Project framing assessment

CRITERIA	FLEXIBLE	RIGID
Timing Flexibility	YES	NO
Deliverable definition	DEFINED EX ANTE OR NOT, ADJUSTABLE DURING THE PROJECT	DEFINED EX ANTE AND NOT CHANGEABLE
Reporting	DEPENDING ON ACTORS' INTERESTS	STABILIZED REPORTING
Typology and number of partners	NOT DEFINED EX ANTE AND ADJUSTABLE	DEFINED EX ANTE AND NOT CHANGEABLE
Conception tools (related to project management and performance measurement)	DESIGN DRIVEN CONCEPTION RELATED AND CHANGEABLE	TRADITIONAL PROJECT MANAGEMENT AND NOT CHANGEABLE
Governance	DIFFUSED	CENTRALIZED

By the analysis on these dimensions, we identified four typologies of proto-ecosystem project, represented in the following table:

Table 34 Proto-ecosystem project typologies



Let's take a closer look to each typology of proto-ecosystem project.

Flexible and Close

The first typology of project, called **Flexible and Close**, is characterized by a certain degree of timing flexibility, based on the possibility of changing the project timeline and deliverable due date, and by the possibility of adjusting the deliverable definition during the project. The typology and the number of partners are modifiable during the project depending on the evolution of needs in terms of technical competences and knowledge. The conception tools used to manage the innovation process and for performance measurement are linked to design driven theories and practices. The governance of such a projects appeared to be diffused and not centralized in one actor. Nevertheless, such projects are defined as close on the other dimension because they have a strong interaction with headquarter, they are visible by the top management, and the participants are connected to the operational activities (product/service development and commercialization) and they are able to involve colleagues from other business units.

The observed project corresponding to this typology is the Autonomous Driving vision exploration at Le Square. In such context, we find matching factors as far as interaction performance with the Close typology. The project was visible within companies and at the top level as part of the "smart city" initiatives some actors were pursuing. The coordination was performed as a top-down model, having the initiative authorization from the top management to go on, within a certain level of boundaries within the firm. The level of integration between the partners part of the projects and firms' operational activities is appreciable, due to the merging of partners' activity in the project and goal of their division. The position of such individuals into the organization chart allows the structuring of a solid network with other business units, and in some cases, the merging of short term targets, originating transversal team support (with another innovation development team in the case of the OEM for instance).

As far as the project framing is concerned, the setting of the project initially involved a preliminary definition of time-plan (with indications of milestones derived by Design Thinking methodology), deliverable expected, initial setting of creative process to be followed (C-K theory based) and an initial list of partners to be involved in the exploration. The reporting was informal among the participants and between the team and headquarters, with a first moment of official feedback at the end of the observation period. The governance of the exploration project was since the beginning performed by a pool of participants, in a collaborative and participative way (including the information sharing tools used during the project).

Flexible and Far

The second typology, called **Flexible and Far**, has the same project framing as the first typology, but it differs on the interaction with headquarter. In this dimension, project participants are distant from the top management, they do not necessarily interact with the operational teams, and they do not have the power to involve other business units in their project.

One example of such typology is the exploration platform developed by innovation organization such as IdeasLab, a community of selected funding partners (CEA, France Telecom, ST Microelectronics and HP) established in Grenoble since 2001 and integrating teams coming from several private R&D centers. Through this exploration organization, projects are developed for the exploration of collaborative and participatory innovation, targeting the invention and testing of applications emerging from micro and nanotechnologies, in a large panel of sectors (e.g. real estate, energy, mobility, healthcare, autonomy, well-being, territories, arts &cultures). Some tangible and intangible means are shared toward the goal of creative process ignition and output sharing within the community. Among tangible means, funding partners provide the community a budget of 50 à 150.000 Euro each.

As far the interaction with headquarters dimension is concerned, the project participants are physically and hierarchically far from headquarters, although the engagement to participate to the project is strong (for each partners 1 to 3 people in the IdeasLab platform for 3-5 years). The legal identity of the community is a temporary association without corporate entity establishment. The coordination of the activity is similar to a bottom up configuration, starting from a specific application to be eventually later be translated into some more meaningful (business and strategy-wise) for the companies participating to it and for potential complementors.

Furthermore in such projects, the people part of the team developing the project are not integrated into operational activities, as well as other business units involvement during the development of the projects.

As far as project framing is concerned, the time-plan of the project is defined at the beginning of such project, but it might accept modifications. The deliverable and typology of partners to be involved are also defined at project kick-off, but in the aim of maximizing the result in terms of imagining and testing emerging application of technologies, a certain degree of flexibility is accepted. The conception tools are based on creative practices for IdeasLab, including prototyping, experimentation and learning process. Project reporting is framed by the project step cycle, including creativity phase, modelling, prototyping, uses and acceptability studies, marketing and business model elements. As per the interests of all participants, reports on innovation performance achievement such functional model, a promotional video, an assessment on technology, uses, potential market, and on potential patents associated to the exploration result are provided to each partners, as well as personalized recommendations for strategic decisions on exploitation.

Project governance is partially centralized to main partners, via formal tools such Steering Committee (CODIR) in charge of orienting strategy, and partially decentralized to projects' participants via informal tools such as "friends' network" on specific themes.

Close and Rigid

The third typology, called **Close and Rigid**, is characterized by a good performance in interaction with headquarters, being the project participants linked with operational teams and having the power to involve other business units. The typology of coordination is top-down style, being the goal of participation set by the headquarters. As far as project framing, such projects are characterized by a rigid time-plan and reporting rules. No time-plan adaptation is forecasted for project evolution and ongoing discoveries, as well as no changes in deliverables definition and due dates are allowed. Usually negative consequences such as penalties apply in case of delay compared to initial project time-plan setting. Furthermore governance is very centralized; the project has a nominated project leader, whose role is clearly defined by the contract bounding the partners in their collective action. The rigid contract typology hardly allows the involvement of more partners in case the project evolution requires it in order to more effectively comply with deliverable quality expectation. Conception tools are linked to traditional project management, and they are usually not changeable during the project development.

Example of such typology of project is the development of the USB through the Intel Architecture Lab (IAL). The IAL was created in 1991 by Intel in order to become the facilitator for innovation in PC industry and create an ecosystem to stimulate demand far beyond current levels. The creation of this laboratory allowed a private actor to launch innovation projects as a leader by engaging a limited amount of partners through a large variety of subsidies. Benefits from the results were shared in a way to balance the tension between giving the enable entry success to partners and maintaining the position of ecosystem's leader. Projects are governed by a dominant actor who enables via vertical relationship with partners such customer, suppliers and assemblers, the connection of the PC platform to a large set of peripherals and devices from different industries, but in need of fast data exchange with the PC for more desirable use toward final customers. Such projects were successful in driving innovation toward microprocessors complementary products, in creating business possibilities for external companies, in generating new uses of PC and in generate demands for new computers (Gawer and Cusumano, 2002). The early diffusion of Intel technology and IP, the sharing of development tools, engineering capabilities and marketing&sales resources, along with the organization of public events certainly contributed to the success of such initiative among partners (Gawer and Henderson, 2007).

Far and Rigid

The fourth typology of project, called **Far and Rigid**, contemplates projects with participants distant from headquarters. Project participants are seldom in direct contact with the top management of their organization, they do not necessarily interact with the operational teams, and they do not have the power to involve other business units in their project. The coordination follows a bottom up scheme.

As far as the project framing is concerned, the project management follows rigid rules, with structured reporting and no possibility of deliverable or time-plan modification during the project. The composition of the project team is defined upfront and not modifiable. The governance of the project is highly centralized to the project manager.

Examples of this typology are the Horizon 2020 research projects, such as CorriDoor and Automat.

The interaction with headquarters is not strong, as participants belong to units not linked to top management. Their capacity of being involved into operational activities might be observed, but the ability to involve other business units is weak. The typology of coordination appears to be definitely more top-down than bottom up, although some initiatives generated during the project might have some influence on other business units.

The project framing is rigid, outlined by strict contract engagement and conditions. The legal obligations end with the project, and the reporting is defined upfront by rules applying to all EC funded similar research projects. No initiative from partners is accepted, neither in terms of reporting or time-plan changes. The consortium composition is not changeable unless major issues with one participant, in which case replacement is accepted within certain conditions and upon EC approval. Deliverables are strictly defined at project awarding and hardly changeable during the project, as the achievement of the deliverables ignites funds payment from EC to partners. Conception tools do not include any design methodology, but they are based on standard project management approach (Gantt etc).

Governance centralized to the company designated as project manager when the project is awarded to the consortium.

<u>Advantages and disadvantages of Proto-ecosystem project typologies</u>

Based on the above analysis, we considered the four typologies of proto-ecosystem projects related to their performance toward innovation and value creation for each actor taking part to the project. Each of them are in a position to decide if they want to embark in such venture or not, and it will do it based on individual assessment of advantages and disadvantages a specific project might bring to the organization he belongs to.

Once we assessed the holistic proto-ecosystem frame in terms of typology criteria, we apprehended that there are generic mechanisms observable on each case, although with different influence and intensity, that impact project's performance for each participant.

We became aware that, beyond the fact that the global evaluation of a project is given by the sum of individual evaluation of partners and ecosystem participants, every participant's evaluation is not static, but it changes along the project. Based on the advantages experienced and recognized, partners might modify their appreciation of the project which revealed to be more strategic than forecasted when the decision to participate to it was taken.

The above generic mechanisms are the following:

- Generation of internal dynamics (internal existing dynamics modification, organization design and processes changes)

- Chicken&Egg problem solving (definition of demand-offer matching, including tangible/intangible value creation, definition of coherence between investment and profit)

- Ambiguity Steering (exploration vs exploitation in terms of project management and related results)

- Capitalization from project partners' convergence (use of created value within the organization)

It appeared that each project presents specific advantages and disadvantages, linked to its organizational design, established processes, available capabilities and culture.

In the case of Flexible and Close typology, it appeared that the recognized mechanisms performed particularly well in terms of diffusion of users' needs knowledge, as well as the network building across the organization and outside it. The diversity of project management approach and tools used might create tension in the transition between exploration and exploitation, which needs to be acknowledged and managed.

The full results of the mechanisms assessment is presented in the table below:

Table 35 Flexible and Close typology Advantages/Disadvantages evaluation

PROJECT	ADVANTAGES	DISADVANTAGES
Ignition of internal dynamics	• Internal coordination mechanisms are improved on the basis of direct recognition of customers and users needs. • Strong power of relationship, awareness and consensus building	• Modification of processes and organization design needs internal consensus and validation with framed paths. • The lack of definition of project budget and duration might impact the acceptance of the project framing across organization.
C&E problem solving	• Demand-offer matching has high potential of being defined quickly by the freedom of involving progressively the requested actors. Intangible value is created quickly, and it is quickly useable through the organization • Uncertainty debate moves on.	• Offer-demand matching validation needs prototype phase on which internal authorization and bureaucracy might need involved and jeopardize time to test (and therefore potentially time to market).
Ambiguity Steering	• The flexibility of project setting allows a more effective adaptation to project evolution and better performance in exploration	• Exploration phase might last too long compared to standard project management accepted standards, and its value might be hardly accepted by organizations.
Capitalization on partners' convergence	• High level of creation of new competences and knowing. High level of network construction through the project, with new business opportunities definition	• Convergence performance is linked to personal commitment and motivation of individuals. • New opportunities might fail in becoming real if transition between a flexible framed exploration project and rigidly framed exploitation project is not recognized and managed.

If we link these results with the absorptive capacity assessment, the good performance in acquisition and in transformation is confirmed by the performance in mechanisms such as internal dynamics ignition, potentiality of capitalization of new competences and knowing, and facility to involve internal and external contributors for C&E problem solving. Assimilation performance is also related to the internal dynamics ignition.

In the case of Close and Rigid, as literature suggests in the case of Intel, organizational mechanisms allowed the firm to display and enable a commitment toward complementors which was key for the platform success (Gawer and Henderson, 2007). Nevertheless, exploitation logics, departments' targets divergence, and formal engagements on confidentiality might limit the value creation in such structure.

The details of the advantages/disadvantages assessment are presented here below:

Table 36 Close and Rigid typology Advantages/Disadvantages evaluation

PROJECT I	ADVANTAGES	DISADVANTAGES
Ignition of internal dynamics	• The definition of compatibility parameter aligned actions of internal divisions. • Departments actively contribute to the tech exploration momentum • System mindset was spread within organization	• The IAL research activity creates tensions among units driven by different target (open innovation vs direct profit from the IP result of exploration)
C&E problem solving	• Leader and complementors find their way to make successful exploration coherently with their business model. • The exploration subsidies positively engage complementors in exploration and exploitation, bringing tangible and intangible values.	• As enablers of entrants access with no profit target, the projects performance of the strategy on tech and standards open distribution might be sensitive as simultaneously relevant to different departments.
Ambiguity Steering	• The set of a specific element of an organization (IAL) to drive alignment toward a new standard help the coherence of exploration actions within a company and with partners-complementors .	• The tangible value of open approach to exploration is hardly understandable within a short term profit logic of exploitation
Capitalization on partners' convergence	• High credibility of the output of the leader-complementors joint exploration • convergence on standards open competition • Sharing of strategic roadmaps allows the joint creation of benefit for the whole ecosystem to be	• By the neutral position, access to inside information on partners, but limit on internal brokering for confidential agreements.

In the case of Far and Flexible, the structure allows effective knowledge sharing among partners, which has already resulted in innovative initiatives kick-off, such as Movea and Wattway, but the initiatives not always get to the deployment phase as partners fail in aligning during the exploration phase.

Table 37 Far and Flexible typology Advantages/Disadvantages evaluation

PROJECT ideas laboratory	ADVANTAGES	DISADVANTAGES
Ignition of internal dynamics	• Enhancing of internal tasks evolution toward new tech for each partner. • Input on partners' internal roadmap if link with HQ is solid	• Sharing the performance evaluation frame is difficult due to the differences on performance variables among partners
C&E problem solving	• Value created from access to scientific and industrial network • Faster and more effective information sharing, as no confrontation among direct competitors • Competitive advantage from access to new co-created knowledge	• Limited number of partners might limit the performance of systemic-ness and disruptiveness of the result • Difficulty in recognizing intangible value across each partner's organization
Ambiguity Steering	• Clear focus on research-exploration targets such as scientific creativity, technology survey, IP, patents.	• The distance with HQ might jeopardize the deployment management of innovative concepts as per the project management differences of the two
Capitalization on partners' convergence	• Synergies of capital-intensive infrastructure sharing and common roadmaps among partners. • Same rights of use on projects results. • Network building	• Capitalization highly depends upon the influence the department part of the project and its internal structure.

In the case of Far and Rigid, partners experienced difficulties in becoming aware of which value the project delivered, and the distance with the headquarters limits the possibility of internal dynamics ignition and project results capitalization across the organization. The details of the advantages/disadvantages assessment are presented below:

Table 38 Far and Rigid typology Advantages/Disadvantages evaluation

PROJECT	ADVANTAGES	DISADVANTAGES
Ignition of internal dynamics	• Org and processes changes: some modifications in internal org design and processes happen. This depends on the impact of project goal on business strategy and financial results of each partner.	• Internal coordination mechanisms remain unchanged and they jeopardize project performance • Ignited modifications risk to be stopped as project ends by internal processes and traditional project management performance evaluation.
C&E problem solving	• Demand-offer matching process is kicked off in a financially-secured environment. • Value creation: Tangible and intangible values are created. They cross-fertilize other projects • Uncertainty debate moves on.	• Fixed project rules jeopardize speed and width of solving performance
Ambiguity Steering	• Difference btw exploration and exploitation is understood during the project. • Project is a space of learning how to explore for a successful future exploitation	• Partners with a very far link with HQ and low recognition of project impact on business strategy will steer to development/exploitation logic too early. • If market test phase is not included in the project setting, project goal validation is hardly achievable during allowed timeframe
Capitalization on partners' convergence	• Capitalization happen for partners whom aligned interests and strategic roadmap during project, and whom project participants have built a strong connection with C-Level. • Project-enabled new competences and Knowing is at partners disposal.	• Often Project doesn't generate the level of convergence needed to shift the awareness of project's value to a high hierarchical level within companies. Capitalization depends on the links of projects participants to internal structure (other divisions).

In this typology, the distance between the participants and headquarters and the typology of coordination result in a poor performance in information and knowledge transmission among departments. As complex design problems such as innovation deployment in vehicle connectivity involve several departments, this performance heavily impact the transfer of relevant information and knowledge from the departments in which it is generated to the department in which it is more useful and demanded (e.g. the information on data marketplace prototype creation from R&D to Sales and AD departments at OEMs).

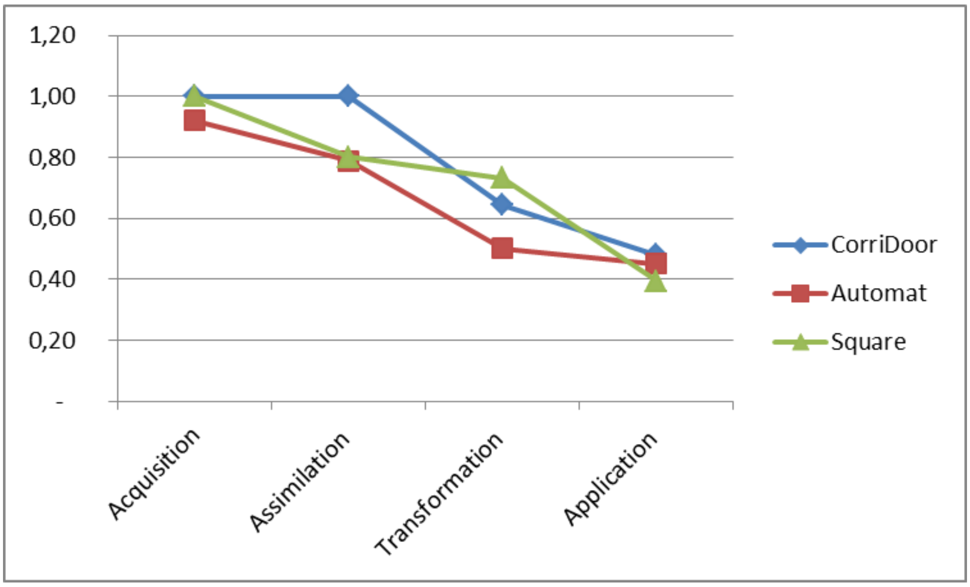
Furthermore, the observations highlighted that the project framing oblige partners to follow a rigid deliverable plan, which in most of the case is not coherent with the real action space each participant has within its organization. This tension between project framing and organization processes results in a self-directed, autonomous project management compared to the organization in which the project is inserted. This practice jeopardizes the link between the project achievement and the possibility of transferring and capitalizing part of such results across organizations.

If considered from competitors-based interaction toward increasing of intensity of investment toward innovation, such projects might create the space in which competitors reciprocally share research findings, increasing their absorptive capacity without the need of the spill overs in order to achieve higher learning easiness, appropriability. Firms in a same industry and across industries are interdependent (profits of each of them are influenced by tech advances of others). Magnitude of absorption incentive could theoretically be reduced in such situation (Cohen and Levinthal, 1990).

5.3.2 The moderating role of knowledge management: the strategic perspective of absorptive capacity

Applying the measurement method proposed in Chapter 4 Methodology, we considered the evolution of key components of potential and realized absorptive capacities., as shown by the table here below and based on Table 1 of (Camisón and Forés, 2010; Zahra and George, 2002).

Figure 71 Evaluation of performance achievement in absorptive capacity during the projects



The above table shows the qualitative appreciation of dimension achievement level.

While scores for the acquisition dimensions are similar among projects, the performances on the other dimensions vary when observed statically, and without further consideration of endogenous and exogenous factors. We can state that all the project partners increased their absorptive capacities, although they did it at different levels

We performed then a crossed analysis with other factors, such as the typology of external knowledge to be acquired, the relationship btw the consortium partner and the headquarter (interfirm distance), the project management applied during the project, the degree of systemic-ness and disruptiveness of the innovation under deployment, project time slot in innovation deployment and the typology of internal organization of the participants.

As first consideration from the above, we confirm that the way the project is designed influence the communication flow between partners and therefore the performance of absorptive capacity (Cohen and Levinthal, 1990) to be developed by partners during the project and to be used as a foundation of a new ecosystem. People working on such a project are directly linked to the potential performance of firms in absorptive capacity. Partners start with a certain level of absorptive capacity, which allows them to formulate expectations in terms of nature of technological advances and its commercial potential, as described by Cohen and Levinthal.

As a further elements to complement the above, we found that taking part to such projects in an emerging ecosystem phase, it generate more uncertainty of what was originally taken into consideration, and this influences the willingness to further invest into the project itself, to keep increasing absorptive capacity. We observed different reactions. The different reactions might be related to each actor organizational setting and history and strategic path in terms of evolution of positioning into the value network. A quickly moving field might de-incent firms to invest in absorptive capacity, resulting in a low-value-capturing positioning in the future.

Furthermore we observed that projects can play the role of dialogue spaces with actors performing different level of difficulty in sharing and learning related to language initial knowledge.

If actors in the projects do not share the same specialized language (only the OEM side, but the language of a new ecosystem is new for most of them and is probably a mix of all the languages), therefore they do not effectively communicate with one another. The dialogue space allows the possibility to tap into diverse external knowledge sources, although this takes a considerable amount of time and cognitive effort.

From a project typology point of view:

- The higher degree in assimilation is associated with the project with higher pressure on commercialization of the innovation and with partners with a previous experience in similar projects and engaged knowledge development in technological field related to the project (i.e. the EV charging, TEN-T projects).

- The project with rigid and traditional project management and prototype deliverable is the less performing in all dimensions, although it is the project in which highest number of partners got so far involved or expressed the interest of getting involved into similar platform-based project in other sectors. This might reflect an established acceptance of consortium-style project, which allow budget within traditionally accepted and short-term-safe project boundaries. Risk-aversion attitude among partners has been detected.

- Both rigid and traditionally managed projects are associated with lower score in transformation, but the overall performance in application seems the same, although the picture we have at the moment is not representative of a performance assessment at the same stage of innovation deployment.

- The project with less rigid and design-driven management scored higher in transformation; partners have a closer relationship with their headquarters, participation willingness, information sharing and combination during the project was higher than in other projects, although the commercial deployment of innovation has not been realized yet. The lack of contractual frame didn’t prevent partners from effective contribution to the project at this early stage of innovation deployment. Such a project is also the one with the most heterogeneous partners’ composition and governance based on collaborative engagement through design methods and practices.

From partners' point of view:

- Better performance in acquisition seems to be associated with partners familiarity to the technical domain in which the external knowledge to be acquired is situated.

- The best performing partners in absorptive capacity resulted to be the organizations for which the participation to ecosystem structuring seems to be key to future survival or it is the best option for future flourishing and key positioning in the ecosystem through the partnership with other companies set during and thank to the ecosystem project.

- The less performant partners are both, far from their headquarters and part of rigid structure.

Different performance might be linked to the different setting (including contractual frame and partners' composition), goals and timelines of projects.

The project with the most concrete goal and the most limited deadline performed apparently better as overall absorptive capacity performance, but the fact that the project with a different project setting performed better in transformation while being at an early stage of innovation deployment, it might be the sign of a future better performance in application when the goal of the project will be achieved. The typology of agreement among partners (from formal contract to informal agreement) and concrete goal might play a role into an overall better performance in absorptive capacity.

Different project setting dimensions shown in Table 25, such as reporting, governance and participation are also elements influencing the absorptive capacity, apparently in dimension of assimilation and transformation.

The above analysis contribute to the understanding of the role of such projects in the improvement of performance in absorptive capacity, and it elucidates that project setting and management is part of a global strategy within a firm investment decision in knowhow and knowledge acquisition and fostering.

Data analysis from cases observation highlight that the use of creative methods increased the absorption of external knowledge among the partners of the projects.

We assessed from data analysis that some partners increased their absorptive capacity during the projects, therefore it is an intangible value contributing to the value creation and business model of the projects themselves and for each company in order to justify the enroll-participation (although in H2020 they are paid for participating), and the extra-cost of extended budget needs discovered during the project.

If we link the results on Chapter 5.3.1 to the absorptive capacity assessment, all the above indicates that organizational structure and culture have an impact on the capitalization of such a project on each partner's roadmap, as well as in defining its position on the future ecosystem. Depending on the current capabilities and on the assessment of capacity of acquiring and integrating new ones (linked to absorptive capacity), each company might assess which typology of project is more suitable for a successful exploration and exploitation of innovation, while determining a realistic sustainable positioning on the ecosystem.

Such results on absorptive capacity elucidate the key role of the interplay between proto-ecosystem projects participation and organizations' structure and settings as the strategic assets building path.

We now have relevant elements for outlining the research path with overview of the journey and perspective for future research.

6 CONCLUSIONS

In this chapter, we synthetize the journey we went through during the field investigation and thesis writing, with main results and indications of future research perspectives.

Empirically, we observed that innovation challenges nowadays widen their context of application from a single industry platform to a multi-industry ecosystem design.
This scope and impact widening are mainly driven by the following aspects:

- the value propositions are built through the participation of actors from heterogeneous industries,
- users' expectations are rising and demanding almost-immediate available fully personalized services,
- technological standards driving interoperability are not defined yet
- regulations associated to systemic and disruptive innovation are evolving at different paces in different countries.

Based on the above elements and on their dynamics, it appears that ecosystems are the new locus of innovation.
Consequently, systemic and disruptive innovation projects include an increasing number of heterogeneous partners, aiming at collaboratively developing more ambitious products or services in an ecosystem with un-defined offer and demand system.

We selected the case of the mobility industry, which shifted from a product centric approach (developing and selling cars) to a systemic approach (electro-mobility ecosystems, smart cities, autonomous mobility), which involves that diverse partners co-construct offers which go far beyond their current core business. The way to manage such strategic evolution and the innovation projects contributing to it is a hot topic.

Accordingly, the innovation management discipline progressively shifted its lenses:

- From a NPD project management perspective to a more strategic multi-project management perspective (involving the consideration of the asset building process during the projects) and to a more "exploration project" perspective implying a more flexible project framing,
- From a firm-centric perspective to an ecosystem centric perspective, involving the alignment of several firms in the innovation process.

However, we find relatively few elements on the way eco-systemic innovation projects can be managed and strategically contribute to organizations' sustainable advantage building strategy.

From a strategy perspective, innovation impacts the focus of organizations involved in eco-system structuring; assets management and entry barriers evolve toward the consideration the management of the assets such dynamic capabilities, the absorptive capacity generated through the participation to the structuring phase and more globally, the impact on the renewal of their strategic agenda. As current innovation challenges are located at overlapping points of industries, we lack insights on how we can strategically evaluate innovation project participation and on the dynamics of engagement toward the collaboration among such players.

From a design and innovation sociology perspective, the exploration and diffusion of systemic and disruptive innovation are largely dependent on interpretation, transformation and re-interpretation mechanisms, as result of co-conception in the social sphere, including the users. Literature provides insights on inter-comprehension mechanisms, as innovation requires teams to de-fix and sense-making collectively. Such collective path requires artefacts and intermediary objects, as well as methodologies to drive the process of exploration, such as C-K theory and Design Thinking methodologies, but no specific indications are provided on tools and processes adequate to the structuring phase of multi-industry eco-systems.

The research questions emerging from the empirical context and the literature review are the following:

- How can an ecosystem project be managed? Is there a specific pattern, and which are the variables of project steering?
- Which are the most performing steering processes for innovation projects involved in ecosystem structuring? Which are the organizational variables and the mediating variables toward eco-systemic structuring?
- Which are the more adequate management artefacts to support the exploration process in a context of ecosystem project?

In this thesis, we try to contribute to the literature on innovation management by characterizing such projects dynamics, putting the emphasis on project management settings, the linkages with partners' internal dynamics, and the effective design and use of artefacts during the project. From a strategy perspective, we aim at providing elements for strategically evaluate and manage the participation to eco-system structuration through systemic and disruptive innovation initiatives.

We therefore analyze three different cases, in the mobility sector: two of them (CorriDoor and Automat) were European driven projects, with rigid project management settings. Le Square initiative was constructed around a company, encompassing several public and private partners, with flexible project management settings.

We first present the main results, then the contribution to the theory of management, and then we provide elements on empirical contributions for management applications. We show how our journey provides elements relevant to the innovation management and the strategic decision making of actors contributing to the structuring of emerging ecosystems.

We also present which limits we identified for our research project, in terms of methodology, theoretical base and empirical study.

We conclude our work with the proposal of the research perspectives that emerged from the journey.

6.1 Main results of the research

The analysis of the cases highlights that, even if the projects companies were involved, in had different timelines and different scope, they all had the same steps in terms of discovery of obstacles, solutions finding, and actions toward goal achievement and future development of project output. A common set of emerging challenges during the process of ecosystem's structuring and a common path of incumbents' participation were identified.

The challenges are resulting in:

- the alignment of concepts and representation for value proposition definition,
- the information sharing among partners,
- the alignment of in-house effort with project effort,
- the focus toward project completion,
- the awareness of the strategic relevance of taking part to ecosystem related projects,
- the necessity of considering a wider target of project, and
- the recognition of specific factors as ignitors to individual and collective action.

Such challenges emerged and can be solved at different step of the project development, as we observed that all partners start with a lack of mutual understanding, which evolves to a collective sense-making through the creation of shared language, the increase involvement of internal and external stakeholders and the creation and sharing of new knowledge.

From the above elements, we found insights to answer the <u>first research question</u> on ecosystem project management.

At some point of the process, the mismatch between an initially established project management setting and the required flexibility involves that partners align on the fact that they SHOULD NOT deliver what has been planned, in order to maximize not only the initial dream but the actual concept and value footprint which emerged during the initial explorations. From observation and data analysis, we inductively identified a process of eco-systemic innovation project management. The driver of each phase identifies its denomination: concept sharing, failure of standard targets, readjustment and external value network and internal diagonal expansion are the four steps of the process.

During these phases, partners deal with the seven key management challenges at different stages of the process. Partners have to go beyond initial wordings ("interoperability", "big data", "prototype", "real time"...) and to shift to a more detailed common understanding of the stakes of the project. For example, partners discover that they do not have the same way to code the data, and have to align on that point. Going through alignment to internal policies with the project specific constraints, they enable the mobilization of an increasing number of internal business units and clearances (legal, strategic,...) which takes time and could put into question the viability of the project. The opportunity to take part to the structuring of an ecosystem relies on the acceptance of cognitive “destabilization” at the beginning, coupled with an “administrative” destabilization originated by the failure in achieving set targets. Through readjustment at project and headquarter levels, partners discover interest of the headquarters for cross-pollination of related projects, and realize that a mutual alignment with some partners is strategically desirable based on and beyond current project.

If we compare the above elements to project management insights available in literature, we find convergent elements such as the strategic ambiguity of innovation projects, but the phases observed vary, as we recognize four steps. In the initial Concept sharing phase partners have to go beyond the individual consolidated meaning of value proposition related concepts ("interoperability", "big data", "prototype", "real time"...) and to shift to a more detailed common understanding of the stakes of the project. For example, partners discover that they do not have the same way to code the data, and have to align on that point. From such sharing, partners have to accept the failure of such projects compared to initially set targets, and to perform the readjustment of internal policies with the project specific constraints. As the project goes forward, it demands to mobilize an increasing number of internal business units and clearances (legal, strategic,...), as well as external stakeholders. This mobilization takes time and put into question the traditional viability and performance of the project, which is to be then reconsidered in terms of tangibility and time frame. Having realized the strategic value brought by the participation to such a project, partners keep devoting resources and time to innovation exploration and deployment even if formally the project is concluded.

We provide evidence of the reasons why such step sequence is an evolution from exploration projects treated by literature. We interpret such difference in exploration phasing as determined by the fact that innovation projects related to ecosystems have management challenges specific to the internal exploration processes and internal and external alignment, which structure the partners’ evolution in four phases. The difference can be related to the fact that such ecosystem projects involve heterogeneous organizations; their heterogeneity generates specific and ineluctable requirements, from the effort toward the conceptual alignment, due to partners’ cognitive distance, to the achievement of internal agreements at each partner level (legal issues, data packages etc.) and internal incentives in order to envision each partner innovation strategy beyond the project.

Such considerations pushed us toward the investigation of specific characteristics of these ecosystem projects, and we found insights to answer the second research question on how strategically select innovation projects involved in ecosystem structuring, and on the relevant mediating variables.

We identify peculiarities of such projects in terms of project settings, organizational factors and role of public authorities.
We find the initial overall settings of the project and partners' characteristics play a great role in the performance of the projects. Organizational factors such as interaction with headquarters and project framing impact shape typologies of ecosystem related projects. We characterize the typologies of far/close in terms of interaction with headquarters and rigid/flexible project framing, which result in four typologies with specific advantages and disadvantages for partners' embarking on them. Projects which are far from the headquarters "radar" for instance, they enjoy a certain degree of freedom which facilitates project completion, but hinders in-house learning dynamics.

In terms of external stakeholder impacting project target achievement, public authorities had different and unclear (and sometimes variable) roles in each observed project. The ambiguous role of public authorities in social value related fields, such as autonomous mobility and data use, leads to several mal-functioning as the needs of a very relevant stakeholder such the shaper of the legal and factual conditions of hard and soft infrastructure prototyping and deployment are taken into consideration late in the process. The consequences are project completion delay and cost increase. The potential role of public authorities as contributor to partners' alignment, users' needs exploration and knowledge creation and sharing supporters is key although not fully acted.

Whatever the initial configuration, one main result is to highlight the role of ecosystem related project in the ignition of dynamics within partners' organizations and among partners. Compared to loose "partnerships", project imposes to the partners to go beyond initial misunderstandings and knowledge distances. The obligation to deliver at different milestones triggers the obligation to converge towards a common value proposition, which involve internal organization evolution.

It appears that innovation situations characterized by high collective dimension and unknown field to be explored, they are contributing to the progressive structuration of the ecosystem based on commonly achieved value propositions and technological standards.
We name such projects "proto-ecosystems projects" since they are an intermediate phase of ecosystem structuring, allowing innovation exploration toward the creation of a viable business ecosystem.

If projects represent a clear incentive to trigger initial actions toward systemic and disruptive innovation exploration, this work highlights the fact that the perceived performance of such project is debatable. If the

project framework provides a clear incentive for partners to align, the ambition to deliver in a relatively short period of time a self-standing and profitable value proposition was quite disappointing.
Partners progressively realized and/or revealed that they use such innovation projects as the less bad solution for them to internally push actions and therefore progress in innovation subjects that otherwise they will never could not aggregate interest, budget release, transversal involvement of other business units and external stakeholders.

As a consequence, the value created in such process should be measured in a more comprehensive and dynamic approach than the one stated for not systemic and not disruptive innovation. Value creation performance can be measured also in the possibility of diagonal expansion based on the knowledge and the network in terms of interactions and transactions firms built during the project and strictly related to the project. Here the proto-eco-systemic project are the mediating variable to have a firm (independent variable) influencing an ecosystem structuring (dependent variable). The diagonal expansion opportunity did not exist before embarking in the project. So the proto-eco-systemic project has an expansive role.

The performance of participating to an emergent ecosystem through such proto-ecosystem projects can therefore be assessed on the value created, which has a dynamic trend from intangible to tangible value from short to medium time horizon and across projects for each organization. It appears that the transformation from intangible to tangible value is realizable only in a medium time horizon and within the cross fertilization of a portfolio of such projects.

In order to maximize such performance, we noted that partners' cognitive alignment is needed and that artefacts are certainly a management tool for achieving it.

As far as the <u>third research question</u>, through the introduction and observation of artefacts and the correspondent individual and collective responses to them, we had been able to provide a typology of artefact which can be used to deal with these challenges. First, providing and sharing concepts and visions of the desirable future can help partners to reduce the knowledge distance among them, and align the in-house efforts towards such common vision. Second, artefacts which materialize the dynamic of the common ecosystem are useful to engage the actors in a cumulative trajectory. We proposed the Significance Prober Process and a dynamic economic model of user's engagement in order to materialize the necessity of progressive partners' and stakeholders' engagement, going beyond the realization of the initial plan. Third, we highlighted the role of specific value representation artefacts (value networks, value footprint for a charging station,...) so that actors can "see" the common value generated.
Through the collective action and use of artefacts, partners and projects are assessed in terms of learning intensity and absorptive capacity. We elucidate the link between such capabilities and organizational design

and proto-ecosystem project typology, as additional input for strategic decision making in ecosystem structuring participation.

6.2 Theoretical contributions and managerial implications

Bridging innovation management theories and ecosystem theories opens a promising research arena. Ecosystem literature shows the ambition of a project like “smart mobility”, which is to trigger the maturation of a public private business ecosystem and also to evolve a socio-technical regime. Innovation management brings the idea of managing dynamically to make explicit the “learning by project” footprint for each partner.

From a theoretical point of view, the identification of “proto-ecosystem project” provides input to move beyond the binary logic of ecosystem projects (it fails if it doesn’t scale up) that is prevalent in the platform leadership and ecosystem management literature. Proto-ecosystem projects appear to be the temporary locus for a progressive structuring of an eco-system. And the structuring of the ecosystem can be done through the contribution of a lineage of projects. Developing an ecosystem is difficult for the high number of choices on the complex system building options to be assessed (Massa and Tucci, 2014), and taking part to it through proto-ecosystem projects might represent a means for choices assessing while taking progressive risks. Furthermore, as positions in the ecosystem are still to be defined, it is a way to steer the organization toward the positioning (bottleneck etc) more coherent with its competitive strategy and capabilities. The participation in a proto-ecosystem project should be evaluated in relationship to this broader goal, instead to the financial or innovation performance of the single project. Eco-system structuring is therefore observable through the lenses of the 4-step process of a lineage of proto-ecosystem projects, shaped through the interplay of organizations structures, projects framing, artefacts design and use timing.

The process of managing proto-ecosystem projects has two new aspects to be considered from a theoretical point of view. From a project management perspective, the project kick-off ignites dynamics at each partner’ internal organization level (such as progressive relevance of the subject, implication of new resources etc), that can be source of project boosting, but also project inhibition. The accurate management of such “in-house introduction” phase is key to innovation process and to be further analyzed. From a value capturing and eco-system positioning perspective, failing at following up on proto-ecosystem project may not be a negative step in firms’ strategy; as strategic value of project’s implications is discovered during the project and through the dynamics generated by these projects, firms can evolve from dominant design related processes and routines to processes including actors and activites once not related in the in-house overall organization design.

In order to complete the theoretical contributions on systemic and disruptive innovation management impacting ecosystem structuring, we elucidate that the value proposition definition and delivery cannot be done without the active contribution of public authorities. Private partners consider they can do without them until they spend time and money to achieve a value proposition that needs to be re-edited, costing more time and more money. Both private and public actors need to acknowledge it. As the dynamic alignment of private and public actors becomes a key condition for systemic and disruptive innovation management (Pinkse, Bohnsack, & Kolk, 2016), we propose to add the consideration of public strategic value of such proto-ecosystemic projects to motivation and commitment of collaborators (O'Leary and Vij, 2012) as ignitor factors for a public manager to collaborate. Playing the role of active contributor generates strategic value for public authorities, as services from such systemic innovation based ecosystem create value for communities. If the ecosystem delivers a value-perceived EVP, people will be willing to adopt the community. Following the principles of luxury brand adoption, such adoption ignites the willingness to devote financial resources to the community in the future.

From a managerial point of view, we provide two sets of contributions.

At innovation management level within the firm, we suggest organizations to consider that proto-ecosystem projects are initially situated at a level that is hierarchically lower and competence-wise narrower compared to the project's ambition. The main issue is to gain legitimacy (and go higher in the hierarchy) and to gain in diagonal engagement (and go transversal within internal stakeholders).

This task of progressive internal territory infiltration and aggregation is challenged by the fact that the output of such projects is hardly directly profitable. Although partners know and/or discover that the direct profitability is not the only output of the project, the settings of current business management tools, such as business plan, are not rich enough to capture indirect or strategic value, such as for instance project impact on partners' absorptive capacity. The path to overcome this structural negative evaluation of the performance of such innovation projects includes the consideration of the project as part of a projects lineage. The perspective must be wider than one single project. Players could rationalize the global impact of this portfolio not only on direct profit, but also on resources, competences, and strategic agenda update. And such perspective change must be done by each participant to the project and by them together, which is an additional innovation management challenge.

From a strategic perspective, participants to proto-ecosystem projects shall embrace a wider vision of organization in order to deliver an adequate EVP. Such vision is achievable with a higher level of consideration of organization settings, which goes beyond one single entity, and it embraces the ecosystem as a holistic organization, not simple the sum of the partners participating to it. Such vision scares. And organizational settings at individual level are not designed to cope with such systemic challenge. Current organization's settings might jeopardize the process of getting quickly (or at all) the conditions required to perform in such challenge, for instance internal and external alignment. The challenge to dominant design is toward every aspect of organizations, and the progressive participation to systemic innovation project will create value when organizations are able to get in the adequate conditions fast, but wisely…*festina lente*.

There is an individual and collective aspect of sense-making for the systemic disruptive innovation, on the demand and on the offer sides of the platform. If the sense-making process is not followed, frustration on both sides and the EVP is not effectively built, nor are users' needs clarified. As users' expectations in the realm of digitally powered ecosystems increase at an un-precedent speed, confidence on innovation and the interplay with the contributors to innovation performance shall be considered dynamically. The strategic impact might be on a reconsideration of which elements of a strategy need to be defined at corporate for a global application and for each of them a fine-tuning definition phase to be forecasted at local level. The factor emerged as driver in such local definition is the homogeneity of territory in terms of uses cases of the communities, influenced by the local regulations applicable. The business model design derived from this approach to strategy should include a more circular path, instead of a still linear vision, with emphasis put on intangible value creation coming from interaction with a larger panel of actors than just customers or users.

Public authorities and regulators have a big role to play in systemic and disruptive innovation exploration and deployment, as their action impact the ignition factors to act for partners taking part to such proto-ecosystemic project. The exploration and deployment of systemic and disruptive innovation in ecosystem structuring shall be achieved with the inclusion of public partners as active player since the beginning of proto-ecosystem projects. Such project typology can allow to track and to manage the learning process of each partner, which also appears as a critical dimension and incentive factor. This also encourages companies and public authorities to consider such projects as stepping stones to aggregate.

6.3 Research Limitations and future perspectives

Our research journey was reach of fields' action, data, discoveries and distillation of results. Proto-ecosystems projects appear to have impacts on partners' innovation roadmap, on complementary assets investments, and strategy toward ecosystem positioning.

From a firm analysis perspective, it would have been beneficial to observe partners before the very first idea of project creation was shared among some of them, and to observe the actors dynamics at

the earlier step to capture the internal dynamics to idea generation.
We would have also appreciated to observe the result of the application of the designed artefacts such as Significance Prober Process and the economic model for a longer time in order to fully assess the conditions and performance of application.
From an ecosystem structuring perspective, we would have appreciated the collection of elements on partners who decided to avoid project participation, in order to assess strategic consequences of not doing so. Furthermore, we would have appreciated to complement our observation on mobility ecosystem structuring with elements from other ecosystems based on digital technology and platform logic, as the integrated healthcare ecosystem. The alignment path of partners in such context would have contributed to the validity of our results beyond the selected field of research.
Nevertheless, although relevant to a limited number of cases, we can affirm that observed cases converge toward emerging relationships among factors, which should contribute to enhance the validity of the latter for future research on the topic (Eisenhardt, 1989).

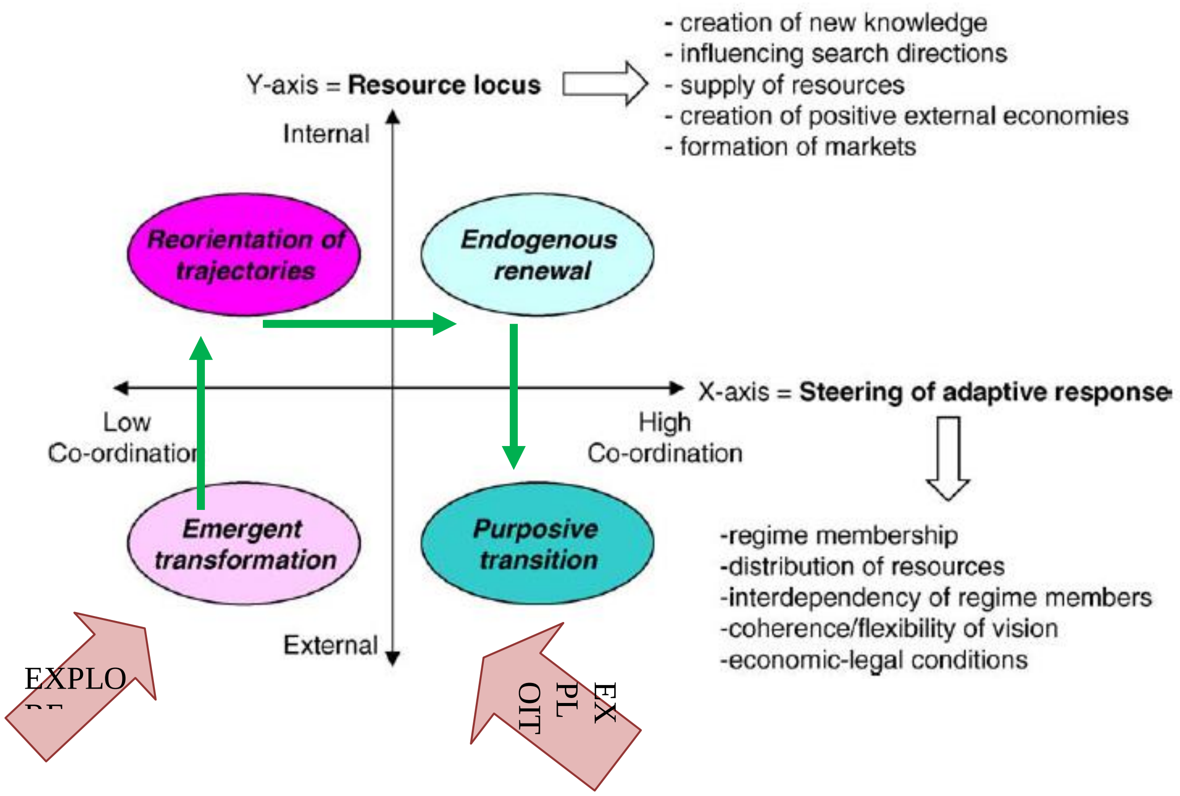
This consideration leads us to the proposal of perspectives for the researches to be performed to progress in the field of interplay between systemic and disruptive innovation and ecosystem structuring.
From a first consideration on innovation management processes and tools, as dominant model for project management in highly uncertain situation/unknown was stated (Lenfle, 2016), we consider that the investigation a dominant model for exploration project management in an ecosystem structuring context could bring elements to clarify the path from the scattered fuzzy initiatives to structured ecosystem. A relevant role in this new stream of research should be devoted to the business model dynamic design in such exploratory projects, and to artefact design and deployment strategy to achieve a valuable alignment for all project participants.
.
Another emerging question is related the interplay between systemic and disruptive innovation development from exploration to deployment and the socio-technical regime shift dynamics. It would be valuable to explore the partners' alignment at a multi-project scale, and to evaluate how such projects can collectively lead towards a socio-technical regime shift. We can make the hypothesis of a path to be followed in systemic and disruptive innovation as the connected autonomous vehicle ecosystem. When we are exploring through proto-eco-systemic projects, organizations are in the realm of emerging transformation as transition context.
The problem highlighted with the cases in innovation value proposition definition is solved in this phase. In order to deploy innovation (as per in the case of CorriDoor), it seems that we need to shift to the Purposive transition as for the systemic characterization; an *uber alles* governance seems

needed at some point. No scalable exploitation without governance at some point, when social value is high, safety concerns include public/private initiatives to merge, and evolution of legal framework. The path to the Purposive transition is achieved by a step within the regime, as creation of new knowledge is achieved and niche markets starts to become concrete.

Here goes the hypothesis of path based on Smith *et al.* socio-technical regime characterization:

1. Emergent transformation
2. Reorientation of trajectories
3. Endogenous renewal
4. Purposive transition and then I have a structured new ecosystem.

Figure 72 Hypothesis of sociotechnical regime shift path



Adapted from Smith *et al.* (2005)

Further research on this topic will contribute to elucidate such path and to provide guidance for strategic decision making and convergence of innovation actors.

The EVP is defined by the elements in interactions, which must be relevant to the end users (Walrave et al., 2017), and we observed that the participation to a proto-ecosystem project allowed the progressive identification of the elements to be included in the EVP, as well as to shape a space where external knowledge should be openly shared and new collaborative knowing (Polanyi, 1958) created. The next step of research shall focus on the conditions and rate of diffusion of the innovation on which the EVP is based upon.

What we observed is that users do value their action in service shaping, as well as the consideration of being part of a community. From a global scale of technology development to a local definition of use, the fulfillment of everyone destiny in its community could become again a sense making factors for users. The new spaces (fixed, mobile or digital) created by the autonomous connected mobility platform can become social engagement spaces and provide value to the city, if users get engaged into the platform.

In previous works, innovation characteristics at the base of general theories such as relative advantage, compatibility, complexity, observability/communicability, trialability/divisibility, image/social apparel and voluntariness (Moore and Benbasat, 1991; Rogers, 2010; Tornatzky and Klein, 1982) have been identified as key to determine the diffusion rate of an innovation.

Frameworks and diffusion theories on innovation diffusion appeared to be based on two hypotheses, among others:

- The environment: the tests and considerations have been done within an organizational context and not an ecosystem

- The width of action of the user: the innovation is emanated by the organization, as a single actor, the user doesn't have the right to take part to its definition and no complementors are needed.

It is relevant to note that elements of behavior considered for assessing the perception of use of an innovation were related to the context of use and a time frame (Ajzen and Fishbein, 1980). And that believes are influenced by antecedents of attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). The relevance of the perception of use of an innovation toward its adoption (Moore and Benbasat, 1991) is since then challenged by the impact of digital technology and the systemic-ness component of innovation in the definition of object/services and the use of them.

In a proto-ecosystem phase in a digital platform context of innovation exploration, deployment and use, we suggest that the current frameworks are not suitable for systemic innovation. The seven characteristics above mentioned are put under stress, as humans have more information available more quickly than ever and they process it differently. The characteristics more impacted might be trial-ability and observability for the scale and time frame provided by the digital technology. Adoption is demanded at a higher speed than before, and fragmentation of users might not be in four categories, but influenced by the context, opening a tridimensional vision of existing analysis frameworks.

The above mentioned challenges (systemic-ness of EVP, different information processing by users and overall acceleration in actions and their visibility), they might impact even before the above mentioned step of innovation diffusion, the persuasion. They act at the level of knowledge and even to the prior conditions described by Rogers (Rogers, 2010). As the context of use becomes global with local peculiarity, and the EVP is generated by several heterogeneous actors, how will the respect of compatibility and complexity levels to perform an intuitively usable output be guaranteed? We identify the criticality of such questions as the answer is linked to the platform-ecosystem dominant position, as it is related to the dominance of use. Will the adoption curve for innovation technologies be shaped differently based on digital technology speed of development and EVP systemic-ness?

7 ANNEXES

7.1 List of Acronyms

AD Autonomous Driving

AV Autonomous Vehicle

B2B Business to Business

B2B2C Business to Business to Consumer

B2C Business to Consumer

B2G Business to Government

B2X Business to Exchange

G2C Government to Consumer

BMC Business Model Canvas

CES: Consumer Electronic Show, Las Vegas

C&E Chicken&Egg

C-K Concept-Knowledge Theory

CSR Corporate Social Responsability

C0 Concept Zero from C-K theory

EC European Commission

EU European Union

EV Electric Vehicle

EVP Ecosystem Value Proposition

GDPR General Data Protection Regulation

HQ Headquarters

ICED: International Conference Engineering Design

IMD Institut de la Mobilite' Durable

IoT Internet of Things

NPD New Product Development

OEM Original Equipment Manufacturer

POC Proof of Concept

PWC PriceWaterhouse Consulting

R&D Research & Development

ROI Return on Investment

SP Service Providers

STIF Syndicat des Transports d'Ile de France

TEN-T TransEuropean Transport Network

VRIO Value Rarity Inimitability Organization

WP Working Package

7.2 Comparative table on systemic-ness, disruptiveness and digitalization

	systemic-ness	disruptive-ness	digitalization	Digitization PWC estimation	How many industrial sectors	Sector
Boeing (787)	40	10	32,08333333	38,5	1 sector	transportation and logistics
Vorwerk (Folletto and Bimbi)	15	20	30,33333333	36,4	1 sector	consumer goods
Intel	30	27	44,08333333	52,9	1 sector	computer and electronics
Oil Industry	47	34	32,08333333	38,5	1 sector	transportation and logistics
Tesla	45	40	44,25	53,1	1 sector	automotive
Apple	50	37	44,08333333	52,9	1 sector	computer and electronics
Autolib	47	45	44,25	53,1	1 sector	automotive
TENT-A	50	47	44,25	53,1	1 sector	automotive
Autonomous vehicle	50	50	44,30555556	53,1666667	mix of sectors	financial services, automotiv
Automat Project	48	50	50	NA	mix of sectors	

7.3 Coding framework

Date	18th december 2014	12th january 2015
Observation duration		
TURNING POINTS		AGREEMENT ON CONTRACT CLAUSES
Step	differences btw contract negotiation and partners internal processes impacts project development. Disagreement on contract mainly because everyone tries to cover his shoulders on the others if users finds something wrong, without even considering the user for service definition. user is mentioned only for legal action against sodetrel.	Deep discussion on liability among partners and lawyers solves the contract signature impasse. Every partner moves within its negotiation allowable space. Geographical position of the station takes a higher relevance in cost determination and in location definition strategy. Interoperability definition agreed and service provider committment on interoperability target. contract mention about good faith on interoperability saves all! agreement on dispute resolution tribunal
STRATEGY		
Offer analysis		
Competences	presence of lawyers and contract related discussions enhance partners legal competences on EV charging service providing and responsibility related issue	The novelty of the user experience formed by new object and new infrastructure, and the awareness of success toward coherent and simultaneous
Roadmaps	OEMs consider to evolve their roadmap with the inclusion of infrastructure management in case of service provider failure	
MANAGEMENT		
process	Unclear definition of main concepts such as interoperability and simple or qualified majority delay the project development. Internal processes	EU budget release eases project internal and partners' internal processes. Discovery of technical complexity and material costs higher than forecasted
product portfolio	OEM: eventually considering to take some actions into services.	the previous experience on UK project provides elements for moving forward on legal, responsibility boundaries not the same.
project perfomances		first station installed. Discovery of installation costs endangers project financial performances.
OTHERS		
Alignment of tech Standards, cognitive positions, roadmaps)	Standards 1.plugs: management of multiplugs system manufacturing, no choice on one standard. 2.interoperability: the definition is not stabilized. different degrees of it are discussed, raising the awareness of national and european implications. Cognitive: interoperability and badge words pointed as not equally understood. Roadmaps: the emergence of a future project as partners' roadmaps complement.	Cognitive: concept definition for liability deeply discussed. Cultural and national laws differences cleared. Standards: open protocols accepted. Collective decision on technical characteristics of the platform agreed by service provider.
C0 (internal and external to project)		Internal C0: interoperable service infrastructure via existing or new marketplace platform. External C0: enhancing power linked to ability to connection to marketplace platform.

7.3 Absorptive Capacity Evaluation

Evaluation scale		***note***
NO action		0
Interest in action expressed, intention to act		0,5
Action undertaken		1

	CORRIDOOR								
Acquisition of external knowledge	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5	Partner 6	Partner 7	Total	% on total per dimension
locate	1	1	1	1	1	1	1	7	100%
identify	1	1	1	1	1	1	1	7	100%
value	1	1	1	1	1	1	1	7	100%
acquire	1	1	1	1	1	1	1	7	100%
Total:	1	1	1	1	1	1	1	7	100%
Assimilation : routines and processes for using external knowledge for:									
analyze	1	1	1	1	1	1	1	7	100%
process	1	1	1	1	1	1	1	7	100%
interpret	1	1	1	1	1	1	1	7	100%
understanding	1	1	1	1	1	1	1	7	100%
internalize	1	1	1	1	1	1	1	7	100%
classify	1	1	1	1	1	1	1	7	100%
Total:	1	1	1	1	1	1	1	7	100%
Transformation : development and refine of internal routines for:									
transfer previous knowledge with new knowledge	1	0,5	0,5	1	1	1	0	5	71%
combinate previous knowledge with new knowledge	1	0,5	0,5	1	1	1	1	6	86%
adding knowledge	1	1	1	1	1	1	1	7	100%
eliminating knowledge	0	0	0	0	0	0	0	0	0%
Total:	0,75	0,5	0,5	0,75	0,75	0,75	0,5	4,5	64%
Application :capacity of new organizational routines to incorporate new knowledge into operations									
leverage existing routines, processes, competences and knowledge	1	0,5	0,5	0,5	0,5	1	0	4	57%
create new operations, competences, routines, goods and organizational forms	0,5	0	0	0,5	0,7	1	0	2,7	39%
Total:	0,75	0,25	0,25	0,5	0,6	1	0	3,35	48%

	CORRIDOOR							
DIMENSIONS	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5	Partner 6	Partner 7	Total
Acquisition	1	1	1	1	1	1	1	7
Assimilation	1	1	1	1	1	1	1	7
Transformation	0,75	0,5	0,5	0,75	0,75	0,75	0,5	4,5
Application	0,75	0,25	0,25	0,5	0,6	1	0	3,35
Total	3,5	2,75	2,75	3,25	3,35	3,75	2,5	

	AUTOMAT												
Acquisition of external knowledge	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5	Partner 6	Partner 7	Partner 8	Partner 9	Partner 10	Partner 11	Total	%
locate	1	1	0,5	1	1	1	1	1	1	1	1	10,5	95%
identify	1	1	0,5	1	1	1	1	1	1	1	1	10,5	95%
value	0,5	0	0,5	1	1	1	1	1	1	1	1	9	82%
acquire	1	0,5	1	1	1	1	1	1	1	1	1	10,5	95%
Total:	0,875	0,625	0,625	1	1	1	1	1	1	1	1	10,125	92%
Assimilation : routines and processes for using external knowledge for:													
analyze	1	1	1	1	1	1	1	1	1	1	1	11	100%
process	1	1	1	1	1	1	1	1	1	1	1	11	100%
interpret	1	1	1	1	0	0,5	1	1	1	1	1	9,5	86%
understanding	1	1	1	1	0	0,5	1	1	1	1	1	9,5	86%
internalize	1	0	0	1	0	0	1	0	1	0,5	0,5	5	45%
classify	1	0	0	1	0	0	1	0	1	1	1	6	55%
Total:	1	0,66666667	0,66666667	1	0,33333333	0,5	1	0,66666667	1	0,91666667	0,91666667	8,66666667	79%
Transformation : development and refine of internal routines for:													
transfer previous knowledge with new knowledge	0,5	1	0	1	0	0	1	1	0	1	0,5	6	55%
combinate previous knowledge with new knowledge	0,5	1	0,5	1	0	1	1	1	0	1	0,5	7,5	68%
adding knowledge	1	1	0,5	1	0	1	1	1	0	1	1	8,5	77%
eliminating knowledge	0	0	0	0	0	0	0	0	0	0	0	0	0%
Total:	0,5	0,75	0,25	0,75	0	0,5	0,75	0,75	0	0,75	0,5	5,5	50%
Application :capacity of new organizational routines to incorporate new knowledge into operations													
leverage existing routines, processes, competences and knowledge	0,5	1	0	1	0	0,5	1	0	0	1	0,5	5,5	50%
create new operations, competences, routines, goods and organizational forms	0,5	1	0	1	0	0,5	1	0	0	0,5	0	4,5	41%
Total:	0,5	1	0	1	0	0,5	1	0	0	0,75	0,25	5	45%

	AUTOMAT												
DIMENSIONS	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5	Partner 6	Partner 7	Partner 8	Partner 9	Partner 10	Partner 11	Total	%
Acquisition	0,875	0,625	0,625	1	1	1	1	1	1	1	1	10,125	92%
Assimilation	1	0,66666667	0,66666667	1	0,33333333	0,5	1	0,66666667	1	0,91666667	0,91666667	8,66666667	79%
Transformation	0,5	0,75	0,25	0,75	0	0,5	0,75	0,75	0	0,75	0,5	5,5	50%
Application	0,5	1	0	1	0	0,5	1	0	0	0,75	0,25	5	45%
Total	2,875	3,04166667	1,54166667	3,75	1,33333333	2,5	3,75	2,41666667	2	3,41666667	2,66666667		

	SQUARE								
Acquisition of external knowledge	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5	Partner 6	Partner 7	Total	%
locate	1	1	1	1	1	1	1	7	100%
identify	1	1	1	1	1	1	1	7	100%
value	1	1	1	1	1	1	1	7	100%
acquire	1	1	1	1	1	1	1	7	100%
Total:	1	1	1	1	1	1	1	7	100%
Assimilation : routines and processes for using external knowledge for:									
analyze	1	1	1	1	0,3	0,8	1	6,1	87%
process	1	1	1	1	1	0,5	1	6,5	93%
interpret	1	1	1	1	0,3	1	1	6,3	90%
understanding	1	1	1	1	0,4	0,5	1	5,9	84%
internalize	1	1	1	1	0,2	0,1	0	4,3	61%
classify	1	1	1	1	0,5	0	0	4,5	64%
Total:	1	1	1	1	0,45	0,48333333	0,66666667	5,6	80%
Transformation : development and refine of internal routines for:									
transfer previous knowledge with new knowledge	1	1	1	1	1	1	1	7	100%
combinate previous knowledge with new knowledge	1	1	1	1	0,7	0,8	1	6,5	93%
adding knowledge	1	1	1	1	1	1	1	7	100%
eliminating knowledge	0	0	0	0	0	0	0	0	0%
Total:	0,75	0,75	0,75	0,75	0,675	0,7	0,75	5,125	73%
Application :capacity of new organizational routines to incorporate new knowledge into operations									
leverage existing routines, processes, competences and knowledge	1	1	0,5	0,5	0,5	0	0	3,5	50%
create new operations, competences, routines, goods and organizational forms	0,5	1	0	0,5	0	0	0	2	29%
Total:	0,75	1	0,25	0,5	0,25	0	0	2,75	39%

	SQUARE								
DIMENSIONS	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5	Partner 6	Partner 7	Total	%
Acquisition	1	1	1	1	1	1	1	7	100%
Assimilation	1	1	1	1	0,45	0,48333333	0,66666667	5,6	80%
Transformation	0,75	0,75	0,75	0,75	0,675	0,7	0,75	5,125	73%
Application	0,75	1	0,25	0,5	0,25	0	0	2,75	39%
Total	3,5	3,75	3	3,25	2,375	2,18333333	2,41666667		

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