Exploring value and steering innovation. The case of telecommunication services for professionals

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1   Introduction

Exploring how value is perceived by customers is part of the operations that are now seen as unavoidable in the development of new products and services. While this exploratory process can take on different forms, depending on the economic sector, there is probably no area left where innovators passively wait for the crucial moment of bringing an innovation to the market to discover how potential adopters perceive its value. Yet the way in which this exploration is implemented in development processes can be problematic when the actor who is targeted by the innovation – who we will call here the "recipient"[4] of the innovation– is a collective. This is the case for instance for professional services that are intended for organizations like companies or administrations. The customer value of the innovation can then be approached in different ways, depending on the actors of the collective targeted. In this paper we examine this issue of the multiplicity of expressions of the value of services intended for organizations, and the tensions that it induces in the running of a project. To what extent can innovators expect a convergence between various ways of assessing value, and possibly combine them so that relevant decisions can be taken to steer the innovation?

One area in which the question raised is particularly sensitive is the provision of telecommunication services for companies and administrations. These configurations are characterized by the plurality of actors using the service, in organizational contexts that are themselves variable (final user, IT and

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[4] We use "recipient of the innovation" to translate the French "destinataire de l'innovation".

telecom managers, corporate managers, etc.), and by the diversity of forms of evaluation involved in project development. We examine this question based on a monograph concerned with a particularly rich case in this respect: the design of videophone services for medical applications and, in particular, applications for home hospitalization (hereafter referred to as HH). In this monograph we reconstructed the trajectory of *VisioHH*, a project launched at the turn of this century to develop equipment and services for the facilitation of interaction between medical teams and the home of patients receiving HH care. We now examine the way in which the qualification of value was implemented at different stages of this project. We first summarize several salient features of the qualification of value, drawing on existing work, and present our survey of the VisioHH project. We then examine in detail the modalities of qualification of value that took place throughout the project. To conclude, we look at how these processes are involved in the steering of the innovation.

2   How can the value of services for organizations be qualified?

2.1   Research on the analysis of upstream value and on the penetration of ICT within firms

Questions on customer value have been analyzed from various disciplinary perspectives. In marketing, the interest in value complements the attention traditionally paid to needs in the study of the formation of competitive advantages (Woodruf, 1997). It endorses the idea that the users of new products can grasp their value without necessarily relating it to pre-existing needs. The entire field of new technologies, including for example communication technologies, is filled with examples of innovations that appeared without any prior needs, not even latent needs, being identifiable *ex ante*. Sociologists and management researchers see value as one of the dimensions – alongside other aspects such as uses – whose qualification must now be specifically addressed in project processes (Le Masson et al, 2006; Veyrat, 2008; Trompette and Blanco, 2009).

Even though the qualification of customer value is thus seen as an important step in innovation projects, there is little consensus in available research on the way in which it is to be implemented in real-life situations. As Charue Duboc et al (2010) point out, measuring the perceived value by means of a classical approach in which the innovation prototype is submitted to a panel of users who then test it, has significant limits: it takes place late in the innovation process; if it is to yield detailed results, the user panel has to be segmented – with the risk that the segmentation, based on existing knowledge of the

market, is unsuited to the innovation in question; and finally, the results obtained do not as such make it possible to situate the value perceived by the customer within the entire value created – which, from the classical perspective of Chesbrough and Rosenbloom (2002), would require an innovation business model. Garel and Rosier (2008) have stressed the need to adopt a specific conceptualization of value for early innovation development phases; one that moves away from an assessment linked to the value chain. They show that even before formalizing the business model, it is important to identify the unusual situations in which the innovation is likely to provide potential benefits. To solve this problem, they propose to base the expression of upstream value on an examination of the "useful effects" ("*effets utiles*") of innovation – which implies a specific exploration of the situations of use, beyond regular or pre-existing contexts.

The question of the diversity of points of view on the value of innovation, associated with the existence of different potential users, is hardly taken into account in these studies. Trompette and Blanco (2009) point out that approaches which integrate the user's point of view in design are based on a plurality of possible figures representing the user – customers, users, citizens, concerned groups, user organizations, etc. – but that the exact articulations between these figures, sometimes a same actor representing several, remain to be studied. Likewise, the approach proposed by Garel and Rosier (2008) provides no framework for examining situations where the "useful effects" of an innovation can be perceived differently by several actors concerned by the innovation in different ways.

Research on the implementation of information systems in organizations provides different approaches. The question of the valuation – in the financial and accounting sense – of investments in information systems has generated many debates, whether examined from the angle of investment portfolios (Ciborra, 2001) or that of returns on investment (Murphy and Simon, 2002). These debates primarily take the point of view of the managers of information systems into account. A whole body of research on information systems' penetration in organizations is moreover aimed at understanding how the various actors of a firm or an administration react, cooperate, resist, and reconfigure their common *modus operandi* during the deployment of a new information system. Such research tends to examine uses and organizational changes (Orlikowski, 2000; De Vaujany, 2003; Segrestin, 2004), without the precise link to the question of value being made. Ultimately, we can consider that these two perspectives converge only very partially: either they take into account the question of value, but focus only on a particular actor of the organization, or they examine more collective and more dynamic phenomena, without addressing the issue of value as such.

Even though they do not directly inform the exploration of value in project management, studies on information systems in organizations do nevertheless highlight two important points in this respect. First, they emphasize the fact that the notion of a recipient of the innovation must be addressed from an emergent and dynamic perspective. It is often as the innovation is taking shape or being introduced into the target organization that the identity of the users, as well as the ties that bind them, are clarified. The study of the changes associated with the implementation of information systems in organizations shows the importance of the ties between actors, which are the product of the innovation dynamic. Second, these studies urge us to be extremely attentive to the relations that exist between the dynamic of establishment of uses, and the emergence of the qualification of values. As the "useful effects" perspective proposed by Garel and Rosier (2008) shows, the perception of value is closely bound to actual uses. In a context where those uses are evolving and partially result from processes of negotiation within the organization, the trials through which value is qualified can experience intense variations.

2.2 The VisioHH case

We draw on these different insights to set out our investigative approach. VisioHH is a research project that was carried out by the R&D division of a telecommunication operator that we here call *Télécom 2000*[5]. This case is not a success story, since it eventually led to the innovation being abandoned. However, as is sometimes the case with failures, it affords multiple insights for reflection on innovation trajectories. First, the innovation involved several different project phases which, from 1998 to 2006, put to the test a whole series of assumptions on user contexts and the technical devices concerned. This particularly dense exploratory process incorporated contrasting problematizations of customer value, and thus brought to the fore significant problems of convergence faced by the innovators. Second, the innovation was carried out with close attention paid to the service's recipients, in an approach which, in a sense, complied with the rules of user-centered design: the recipients' interest in the service was assessed through several modalities. Finally, the case is situated within a field of application in which the plurality of actors concerned (patients, medical staff, supervisors or managers in the administrative and supervisory authorities, etc.) gives a very particular dimension to the question of value assessment. We know that the implementation of information and telecommunication services in this medical sector is underpinned by complex logics, not only because the organizational units concerned are regulated by particular modes of functioning, but also because the assessment of systems' performance poses very

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[5] The names used here are pseudonyms.

particular problems (Chaudhry et al, 2006). We here focus on the question of the qualification of value, by examining the way in which it was implemented in various stages of the project.

The analysis that we propose here is based on empirical research which enabled us to reconstruct the main stages of this innovation. In 2008 we met with a group of actors who had contributed to this project at Télécom 2000 (project managers, researchers, heads of business units), and asked them to tell us about the main phases. We also collected a series of documents on the project (technical notes, evaluation reports, terms of reference, etc.). Even though it affords a view from within the project, which is therefore by definition partial, this material did enable us to reconstruct the various approaches adopted to develop the service and to qualify its perceived value from different perspectives. Bearing this plurality in mind, we focus here on the valuation processes, understood as "the set of accounts, mechanisms, devices and tools that constitute the values and, simultaneously, establish their measurement" (Callon, 2009: 253). This approach, which aims at escaping the classical dichotomies (technical value/market value, customer value/upstream value, social values/economic values) or, at least, at attempting to conceive of their articulation more adequately, corresponds to current reflection in various research fields on valuation-related questions (Stark, 2009; Lamont, 2012; Kjellberg, Mallard et al, 2013).

Our analysis focuses on the valuation undertaken in three types of trial that were implemented to qualify the targeted users' reception of the innovation. While the chronology of the project constitutes the backdrop to the presentation of these trials, our aim here is not to dissect the trajectory in detail, but rather to show the specific forms that valuation takes on at different stages. The first type of trial corresponds to the approaches implemented at the beginning of the project, before any service existed, with a view to producing knowledge and understanding the recipients (here the HH world). They consisted of ethnographic surveys on professional practices and a concept test using a focus group. The second type of trial was *in situ* experiments using a prototype. Several approaches of this type were adopted in this project, based every time on different contexts of implementation. The third type of trial brings together various operations of economic valuation of the innovation that led to changes being made to the concept proposed and, eventually, to the project gradually being discontinued.

3 Exploring the value of the VisioHH project

3.1 Valuing the innovation in the early stages

Our research enabled us to meet the person who was to steer the development of the VisioHH project for several years. He was a young researcher called Luc, who had joined the R&D division of Télécom 2000 at the end of 1997 to work on a subject that he was passionately interested in: the development of ICT in the medical sector and especially in situations of home hospitalization. Having witnessed the presentation at the R&D division of an exploratory project for virtual visits to historical buildings, which eloquently demonstrated the potentialities of the new videophone technologies, Luc envisaged the integration of this dimension into his own projects. This was to spawn the VisioHH project which was launched in 1998 under a partnership with the HH service of the Grenoble university hospital. Although it was based largely on the exploitation of an existing technology, videophony, the project was immediately aimed at integrating the recipients of the innovation into the design process. The researchers therefore adopted various approaches to become familiar with these users' world and to identify their expectations and needs. The first phases of the project included launching an ethnographic study of HH activities, followed by a series of focus groups.

3.1.1 The ethnographic survey

For a month the project's multidisciplinary team, comprising computer engineers, ergonomists and sociologists, worked on the ethnographic study. During this study the project team implemented a data collection and analysis protocol consisting of *in situ* observations, document analysis, interviews, and experiments. This allowed it to become familiar with the process of admission to HH and the actors involved: the family doctor files an application for HH with the HH service; the coordinating doctor of the HH service examines the patient, opens a medical file and defines a care protocol for the patient; and the patient is hospitalized at home. The study also provided a description of ordinary practices, sequences of activities and the distribution of roles involved in this particular form of organization of medical care: the medical staff, excluding the doctor and intern, regularly go to the patient's home, depending on the pathology and care to be provided (e.g. midwives intervene in the case of difficult pregnancies, nurses for post-operation care, etc.); the evolution of the patients' condition is monitored at weekly staff meetings where the medical team describes the patients' symptoms so that the doctor can decide on the care to provide. Overall, the survey was intended to provide the project team with an understanding of

the medical team's work, and to analyze the secretariat's telephone calls in order to determine how videophony could be introduced into the activities of all the staff (secretary, nurses, doctors, etc.).

As we can see, this *ex ante* qualitative survey phase afforded an opportunity for the innovators to discover the collective in which the device was to be installed. While a group of possible recipients appeared at the heart of this investigative work, no ethnographic study can cover an entire sector of activity. In the activities really studied choices are made, whether explicitly or not. Here the ethnographic study focused on situations of face-to-face or telephone interaction between professionals or with the patient. This choice was guided by the idea of strongly organizing the device envisaged around the "videophone" technology. In a sense, for the members of the project team the idea was to construct the value of this technology within the HH context, and this value was to depend on the system's ability to support interactions between the individuals involved in HH, including the patients, and above all to replace face-to-face interaction with remote interaction. The choice of these situations of interaction therefore favoured an ethnographic study of the role of nurses in the circulation of information. In the situations observed, the nurse was the pivotal point of interaction between the patient and the other professionals. By becoming more familiar with the nurses' work, it is possible to infer the needs for information exchange between doctors, nurses and patients. This research choice was subsequently to have a decisive effect on the design process.

Several activities emblematic of HH, such as the staff meetings or the nurses' rounds, were therefore points of anchorage for the design process. At this stage, and given the absence of a prototype, value was identified primarily through the process of projecting the technical concept on the identified activity. The researchers imagined the sequences of use of a service in virtual terms, which could interlink with the real activities that the survey documented, so that a credible representation of the technology in its context of use could be proposed. The devices envisaged to define or enrich the service concept stemmed from this approach. For example, the designers took into account the fact that the HH patient was not supposed to be sitting in front of his or her computer, and that a video camera which the nurse or doctor could control remotely would provide added value by allowing certain specific areas of the body to be filmed. Apart from observing that which already existed, the members of the team could also initiate certain challenges, such as proposing that the nurses use certain photos:

> *I remember the case of a nurse who did home care. She examined a little girl whose burns were not healing well. She informed the doctor of this but he thought she was exaggerating. I had the idea of giving her a*

camera because it was clear that the doctor would not go to the patient's home. The doctor had to admit

that there was a healing problem. (Sociologist, member of the project team)

The approach adopted here consisted in bringing the value of videophony to the fore by testing a device that provided similar functionalities, while also suggesting a new distribution of roles. Through the use of the camera, the nurse contributed to the remote diagnosis. The observations and interviews enabled the team to represent the use value of videophony within the emblematic activities of HH. The team sought to identify the various "useful effects" of the technology in use, for example through gains in terms of organizing the nurses' rounds, and possibly making these rounds less frequent:

When they found themselves together, they spoke about the patients that they had each seen in their homes. Sometimes, several of them were caring for the same patient, and our idea was to see how they tried to deal with a problem when they were not in the patient's presence. What was interesting, was to see how the nurse tried to describe things. We wanted to see where the Visio was going to provide a benefit. Obviously the nurse tried to describe what she saw, wounds for example, the patient's condition and for sure, when one can see a photo it's much better. That, plus the fact that they can't always see all the patients in a morning's round, makes the Visio really useful. (Sociologist, member of the project team)

It therefore seemed that the project team used no formal valuation methodology, as such. The survey that it carried out was designed to highlight elements of effective value of the innovation, projected on the HH context. As we saw above in the case of the camera, the survey formats used leave room for meaningful anecdotes that can serve to script essentially singular use values. But they also lead to a more synthetic and targeted formulation of the "benefits" for the recipients, who are defined according to diverse perspectives. Hence, in our interviews, the members of the project team summed up the three aspects that drew their attention, and that they highlighted as points of anchorage for the development of the project: the videophone image conveyed an added value as a system of evidence or a means to save time in the ordinary practice of medical expertise; the device could generate travel savings; and it seemed to have an effect in "reassuring" patients and, to some extent, nurses as well.

3.1.2 The focus groups

This first survey was followed by focus groups, in two separate phases. In the first phase, the aim was to broaden the scope and enrich the data highlighted during the ethnographic study. The project team held a brainstorming session on the activity of the users concerned and asked them to talk about the medical acts that they performed, the communication channels that they used in the course of their work, and so on. This was then used to design *possible services*: the ergonomists and sociologists developed a service

concept (the videophone service specifically tailored to home hospitalization), which they illustrated with various use scenarios (discussing the patient's condition during staff meetings, the HH patients' calls in cases of emergency, etc.). The users were then invited to a second focus group session, where the concept of use scenarios was presented to them. They *"reacted"* to the concept, *"criticized"* it and *"imagined"* an alternative service and/or functionalities to add to the one presented to them.

From the point of view of value exploration, this process involving the focus group shed new light on the subject, in two respects. First, through its very functioning, it could lead to different scenarios of aggregation of value elements within a collective of recipients: collective interaction in focus group situations facilitates a process of exploration of possibilities, and debate makes it possible to distinguish the contributions of innovation on which there is consensus (therefore translating a collective valuation) and those on which, on the contrary, there is disagreement. These elements appear more clearly than in the ethnographic study, which tends to highlight more individualized judgements on the innovation. The result obtained from the focus group naturally depends heavily on the way in which the group is constituted, with individuals likely to have similar points of view, or not, on the question put to them.

Secondly, the focus group method creates initial "exposure" of the recipients to the service designed for them, and consequently leads to the first valuation stemming from this direct encounter. Whereas at the ethnographic survey stage, it was the members of the project team who inferred elements of value based on their observation of the activity and their ability to project the innovation onto it, what is recorded here are useful effects directly perceived by the recipients themselves. While this slight difference may seem insignificant it is in fact crucial, as it reflects a strong characteristic of the focus group as a device supposed to elicit the recipient's "authentic" opinion on the service proposed to him or her. This characteristic often causes the resulting *verbatims* to be the object of a form of fetishism in project processes. Yet we know that design professionals are not naïve, and that they are fully aware of the need to ensure mediation between these value elements expressed directly by the recipient and the formulation of specifications for the service that is to be created:

> *What we need are people who are capable, in interaction with the techniques used upstream, to hear what the user wants. Actually, it's not really 'to hear what they want', as that doesn't really have meaning, what they want, they always want the impossible. But it's seeing what they do and see, in an existing process, how the services based on telecoms can improve this process. It is, I think, what the team of ergonomists that we had was able to do. They detected what we could provide extra in a service where the patients hospitalized at home saw the medical world with a predefined rhythm. (René, R&D manager specialized in health-related projects)*

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3.2 Valuation in the context of in situ experiment

This first phase of preliminary studies enabled to define a prototype of the VisioHH service, which was then to be tested in several experiments. The first experiment, which we will examine here, was carried out directly after the early phases described above, in the service where the ethnographic study and the focus groups took place. It was designed to test the device in the long term, since it was to last for 389 days, from March 1999 to June 2000. Although this period may seem long this is understandable, given the type of application concerned and the time needed to learn and to draw relevant conclusions from the process. Several prototypes were used, enabling three or four patients to be equipped with the system at the same time. A total of 19 patients benefited from the device: 5 cases of rehabilitation, 3 cases of programmed care, 7 cases of ongoing care, 2 pathological pregnancies, and two cases of paediatric care.

The prototype used (see Figure 1) consisted of a cabinet installed at the patient's home, equipped with a screen, a camera, a keyboard, a microphone and loudspeakers. This cabinet, which could be wheeled around to facilitate its installation, was designed not to look like medical equipment and instead to blend in with the patient's furniture as much as possible. The prototype used by the medical team looked like any desktop computer equipped with a video camera and equipment enabling the user to control certain functionalities of the equipment at the patient's home (in particular, a remote-controlled video camera).
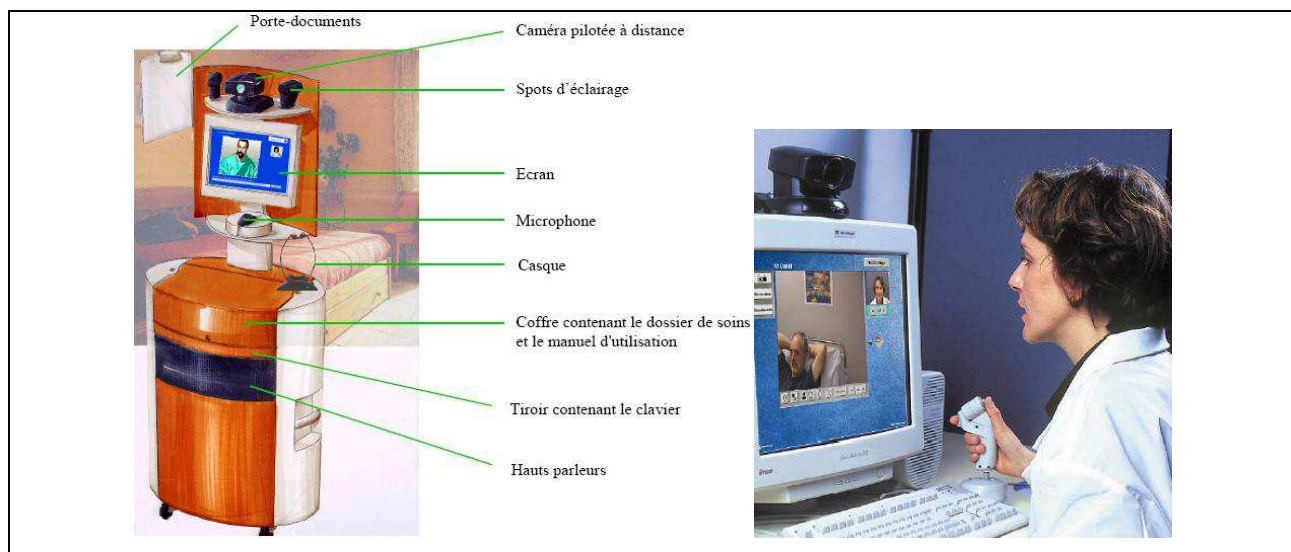

Figure 1: The prototype used in the experiments

The in-situ experiment included training for the users, that is, some of the medical and administrative staff at the HH service of the Grenoble university hospital (CHU). The training concerned the technical aspects of using the device, as well as a series of simulations to facilitate the incorporation of the service into medical practices. These simulations were imagined on the basis of knowledge accumulated by the project team during the previous phases. The patients who were to have a prototype installed in their home were selected by the head of the service, mainly on the basis of medical criteria (expected duration of HH 3 weeks, ability to use a remote control device, absence of viral disease, etc.). This experiment produced abundant data and led to a series of technical and organizational decisions for the project. We focus here on three dimensions that specifically concern our research question: the plurality of modalities of valuation involved in in-situ experiment; the disruptions that the experimental logic might introduce in the production of generalizable value components; and the exploration of the recipients of the innovation. To conclude, we will examine the changes that the project team brought to the project after this experimental phase.

3.2.1 The evaluation articulates medical epistemological criteria and socio-organizational criteria

The idea that the in-situ experiment requires to implement different kinds of evaluation was clearly asserted from the outset. The protocol provided for a medical evaluation headed by the doctor coordinating the HH service, an ergonomic and technical evaluation conducted by the actors of the R&D division at Télécom 2000, and an economic evaluation carried out by an external university laboratory. We focus here on the articulation between the first two types of evaluation. The case shows characteristic effects of implementing two different valuation frameworks within the same project: for certain aspects of the experiment one of the frameworks was prominent, while in other respects forms of complementarity or coexistence were possible.

The selection of patients participating in the experiment matches the first configuration. Even if the above-mentioned criteria used to choose the patients seem restrictive and invalidate any wish to create a representative sample, the approach followed was based on the idea of constituting a corpus of experiments from a medical evaluation perspective. The patients who were identified as potential experimenters were contacted by the HH doctor, in connection with a social worker. The opportunity to participate in an experiment was offered to them and, if they agreed, a protocol contract was signed by both parties. But not all interested candidates received the device, and lots were drawn to divide them into two groups: the members of the "experimenter" group did effectively benefit from the service,

while the members of the "pilot" group did not. The patients in both groups were however taken into account when the medical impacts were determined, so that effects due to the device could be distinguished from other exogenous effects. Thus, all the protagonists in the VisioHH experiment had a recruitment protocol shaped by epistemological considerations inherent to clinical valuation. In this context, the project was viewed somewhat like a medicine whose efficacy must be measured by double blind tests.

The constitution of the information necessary for the valuation relates to the second configuration, as each of the actors collected the data they needed, from their own perspective. Hence, the doctors collected a series of data enabling them to qualify the diagnosis, the patient's psychological and medical condition, and changes in doctor-patient interactions. In particular, they sought to identify the impact of the device on patients' anxiety, as well as its contribution to monitoring patients with pain, to technical nursing care, and to the education of patients and their families. The medical evaluation was moreover to conclude on the acceptability of the videophone in a context of home hospitalization. The team at the Télécom 2000 R&D division collected other types of data as well. It held semi-structured interviews with the patients and medical staff; it requested the HH staff to keep records of videophone calls and of the reasons for these calls and the decisions taken; and certain technical data on the functioning, retained by the system (duration of the call, use of a particular function, etc.), were scrutinized afterwards. These widely diverse elements informed an "ergonomic report", the analyses and recommendations of which were, more generally, to inform a socio-organizational perspective. The objectives that the project actors set were broad and were based on the learning in the preceding phases. As this report indicates, the aim here was:

> *to evaluate the relevance of the videophone concept within the framework of the patient/caregiver relationship, to evaluate the human-machine-interface quality of the devices on both the patient's and the caregiver's side, to make recommendations for a model for introducing the service (organization of work, type of staff, presentation, training), and to identify perspectives and directions for further development. (Excerpt from the ergonomic report)*

The two valuation processes were therefore very different, with regard to both their objectives and their forms. Note however that the two frameworks are not impervious. The project actors that we met pointed out that one of the advantages of the VisioHH which the experiment enabled them to confirm, "reassuring the patients", directly contributed to one of the indicators of medical evaluation, formulated

as the "objective of reducing the patient's anxiety". Conversely, other dimensions identified from their own perspective were not in any way reflected in the medical valuation framework:

> When the nurse was at the patient's home, she would call the HH doctor and he would guide her. He could, for example, use the Visio to see the circle of redness around a wound, and so to assess the inflammation. There could thus be far more personalized patient care because the nurse-doctor pair was working together, otherwise it would not have been possible. So, the doctor was far more involved and this probably had a medical impact. That was not however evaluated because it was not possible to have sufficiently sound protocols to evaluate it. (Marie, ergonomist in the project team)

3.2.2 The experiment has its own dynamics which limited the possibility of generalizing the evaluation results

The second element that we would like to examine concerns the disruptions that the experimental logic can introduce into the production of generalizable value elements. In the VisioHH case we clearly see that the experimentation had its own dynamic which confronted the project leaders with the need to decide on whether the valuations produced were generalizable or not. This effect was due to the fact that the experiments were a significant disruption in the actors' world. Whereas the ethnographic survey or the participation in focus groups produced a limited reconfiguration of their world, the implementation of an entire protocol, the installation of equipment, and the definition of new modes of organizational functioning engaged a series of challenges and far stronger processes of attachment with recipients. In the VisioHH case, this phenomenon influenced the place occupied by two categories of recipients in relation to the project: doctors and nurses. The former tended to become more important than the nurses, who were implicitly placed at the centre of the system in the survey and focus group phase.

The HH doctors seemed to maintain a particular attachment to the device. The way in which they invested in the structuring of the sample, to make the experimentation compatible with a clinical form of valuation, is a sound indicator of their interest in the project. These doctors were hospital academics who pursued the objectives of medical research and wished to test the possibilities of remote auscultation and diagnosis. The experiments were therefore valuable to them, in so far as they enabled them to pursue their own professional objectives. To some extent, the nurses also developed their own attachment to the device. They noted that the use of the videophone equipment was the best way to make contact with available doctors who could rapidly answer their request for diagnosis during visits to

the patient. But these positive assessments were largely counterbalanced by the negative perceptions that were expressed in the survey carried out by the project actors.

During the experiments, the nurses repeatedly complained about difficulties in manipulating a system that did not really correspond to their most immediate needs. They seldom used it to communicate with patients and often reverted to the telephone, which they found more practical. They explained that they preferred to have a mobile phone with a built-in camera, to be able to easily take photos of the wounds or bedsores of the patients they visited, to show to the doctors. Some of them pointed out that managing the VisioHH added to their workload and contributed very little value. The analysis suggested moreover that some reorganization of the HH service would be necessary to develop the use value of the VisioHH and to bring to light the benefits for everyone. Hence, the patients' calls to the HH service had increased substantially, which disrupted the functioning of this service that could not cope with the extra calls. The patients and their families, who had been used to waiting for the nurse to do her rounds, now felt encouraged to call the service via the videophone, even with requests that were not urgent and could have waited for the nurse's visit. As nothing was proposed to manage these calls, the nurses, whose work was disrupted and who found themselves in the uncomfortable position of not being able to respond to new demands, developed a negative experience of the system. Here we clearly see the limits and ambivalence of the experimental situation. The reorganization of the service in response to the dissatisfaction would probably have been undertaken in a context of real deployment of the service, but it was difficult to implement within the framework of an experiment with a system that may or may not be continued.

All in all, the ergonomic report contained an observation that was emblematic of the change of values in the nurses' perception of the system during the experimental phase: *"they could not have mobile phones but they were given a service that was a technological mountain they didn't understand"*. This comment seems to implicitly highlight the hospital administration's indifference regarding the nurses' most basic needs, and the substantial investment it made in a project that benefitted only the doctors in the pursuit of their own objectives, at the cost of considerable organizational dysfunctions.

Most surprisingly, this expression of value (or of non-value of the videophone) by the nurses seems to have been granted only secondary importance in the results of the experiment, as interpreted by the project actors. The alerts that the nurses' negative comments constitute, along with their discontinuation of its use in remote interaction with patients, were not taken into consideration. These difficulties are explained in terms of impediments in the take up of new technologies (relationship with

ICT) which could be reduced with use over a period longer than the duration of an experiment. To ensure that the results of the experiment did not invalidate the project, the technical team preferred to call into question the experimental nature of the approach:

Things really blocked when it came to the quality of the experiment. Users took ages to log on because they forgot their password, they hardly knew how to use the keyboard, so in the end it was a disaster. Sometimes we had to wait for three minutes for the Visio session to open. During those three minutes the patient was on the phone, waiting for the Visio to appear. (Ergonomist)

So we really are in a situation here in which a series of value elements, both positive and negative, were produced. But they were ambivalent, due to their entanglement with the logic of the experiments: on the one hand, the doctors assessed the service positively, but it was because the experiment served their professional objectives; on the other, the nurses assessed it very negatively, but these results were related by the project team to the particularity of an experiment that had not taken place in good conditions. It was ultimately the project team that arbitrated between these two directions and, in a sense, made a choice that can also seem to be opportunistic: it focused on the positive results supporting its own conviction that the general logic of the project ought to be continued.

3.2.3 The experiment reconfigures the perimeter of the actors concerned by the innovation

The experiment also had the effect of inducing an exploration of the perimeter of the recipients concerned. Two points are interesting in the VisioHH case: the emergence of the family doctor, an actor who, until then, had been almost completely overlooked; and the discovery of the fact that the patient's family can play an important role in the use of the device.

Family doctors had not been identified as relevant actors during the ethnographic study and focus group stage. This can be explained by the fact that this actor remained outside the HH process monitored by the project team during the early phases of the study. However, at the experimental stage, three doctors were interviewed. The VisioHH actors saw this as a significant contribution to the project:

The family doctor had been identified as an actor, that's okay, but they made the strategic mistake of not involving them enough from the outset. So then afterwards we were criticized by the doctors concerned, who would have been able to provide us from the word go with a view on the functionalities, and possibly cooperative work. That was really a political mistake. And then on the system, I think that was also a bit of a mistake because it's an important actor and when one or two doctors really played the game we saw really enriching cooperation between the HH doctor and the family doctor. (Marie, ergonomist)

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One of the results of this consultation was that it highlighted a new perspective on the benefits and limits of the system proposed. The family doctor is indeed an important actor in so far as he or she may participate in monitoring the patient, and subsequently takes over from the hospital's service at the end of the HH. This means that he or she needs regular information on the patient's condition. In its original design, the videophone system did not meet this need for coordination, as it could rely on formal written interaction. But when the HH was equipped with a data communication system, the general practitioners could not see why a functionality as simple as the computerized transfer of a diagnosis or an updated patient file had not been provided for.

Patients' families also provided feedback during the experimental phase, along similar lines. Faced with the videophone unit in their family member's home, they naturally became users, probably especially in the case of elderly patients who do not have a good understanding of how to handle the device:

> *It is not necessarily the patient who uses it the most, it's often the family, because the videophone had the particularity of replacing a nurse who no longer existed at people's homes. Because when one is in hospital one presses the button and there's a nurse. When one's at home, the family has no medical training. So, it's panic on board as soon as there's a problem. So this, this enabled us to have a medical opinion. Often then, it was more the family that used it than the person him or herself. (Vincent, ergonomist)*

3.2.4   The project's development following the experiment

After the experiment a new version called VisioHH 2 was created. It was less cumbersome and so easier to transport and to set up in patients' homes. The quality of the image was optimized and the new servers used ensured more efficient functioning. The human-machine interface was moreover modified, based on the users' feedback. But the project team also sought to enhance the system with new functionalities, to add value. The experiment had brought to light many interactions between nurses and patients hospitalized at home, many of which could not be replaced by the videophone system, for instance the help that nurses gave patients in terms of the administrative management of their care. The project team endeavoured to reintegrate these new requests into the device, using a tablet with handwriting recognition. We thus see that, faced with these contradictory feedbacks and protests, and in view of the implications of replacing face-to-face interaction with remote interaction, the temptation to overload the system was great:

> *Apart from medical needs, there were also social needs to cover. The staff, medical and other, has to help patients to read their prescriptions, take their medicines, fill in various papers, for example for social security. So we added a tablet, where the camera can zoom in. This enables*

the staff to advise the patients and help them to read. Users are seen as a whole. … In my opinion, it was a system to reassure and to help people. (Ergonomist, member of the project team)

The experiment also encouraged the project team to explore other functionalities whose potential value had emerged, in order to enhance a videophone device whose advantages had not really been validated. These functionalities first concerned remote visual diagnosis: auscultation (digital stethoscope), 3D views (depth of a wound), and the possibility of having a portable healing station, allowing for mobile videophony. They also concerned the exchange of digital or written information between the patient and professionals, and between professionals themselves. These were needs which a computerized system could meet without videophony: the transmission of data drawn from measuring instruments (monitoring) and communication tools; liaison with other services of the CHU (requesting experts' opinions), and the transmission of laboratory results and data input at the patient's home (secure messaging). Finally, the project team was increasingly oriented towards the most modular offer possible, taking into consideration the specificities of pathologies.

In this first experiment, the main objective was not to qualify the value for the targeted recipient organization as a whole. In particular, it lacked an evaluation of economic benefits. This limit of the first experiment was clearly identified by the project team. In the new experiments, the team increasingly clearly displayed its objective of demonstrating the added value of videophony in a more economic and medical evaluation framework, able to convince insurance companies, the national health fund, etc. A sectoral study was carried out on possible markets for applications, but failed to explore the socio-economic advantages of diffusing this technology.

The sectoral study showed that the HH sector had only 8,000 beds. Within this sector the population that would really be concerned was very difficult to estimate, as the team lacked assumptions on the various reasons for which the system may be adopted, for example the type of pathology where the system offers added value for monitoring, the conditions in which it is possible to replace a hospitalization with a home hospitalization using the system, and so on.

3.3 Valuation near the market launch

As the project evolved significantly from a technical and ergonomic point of view, and knowledge on its "useful effects" started to be established, the R&D management wished to involve new actors in-house, especially the marketing, business and sales departments. The idea was to bring this new technological

device to the market. These new actors entered the scene very progressively. They were to contribute to establishing a new evaluation of the device, within the framework of new experiments, or liaising with prescribers of the organization of medical care.

New experiments were carried out for various medical pathologies: post-operation monitoring and monitoring of at-risk pregnancies, dialysis, and chemotherapies. They enabled the team to develop and test functionalities that were specialized by type of pathology, which led to a shift in the uses tested. The doctors reoriented the tool towards medical acts concerning remote diagnosis, and moved away from the uses initially intended, that is, oral communication between professionals and with the patient. These experiments served as a means to evaluate other useful effects, and a particular effort was made to translate them into economic value for healthcare actors.

3.3.1   Diversified experiments and first attempts at economic valuation

The involvement of the Telecom 2000's business actors facilitated contact with the prescribers or potential financers of the system; for example, a key account manager in charge of an insurance company identified a new field of experimentation. It also facilitated the organization of the experiments, providing the necessary credibility by bringing customer relationships into play.

Once the key account manager was involved in the project and everything had been clearly explained to him, he agreed to participate in an experiment in Italy. All the pilot projects concerning health, for the entire Assurtous group, were carried out in Italy because insurance companies are key players in the Italian healthcare system, especially in the regulation of care and the reduction of medical professionals' claims to insurance companies. The experiments, and by extension the videophone device, benefited from this partner's experience for the early stages of reflection on a hypothetical business model.

The project team worked at improving the prototype, based on the results obtained in the previous experiment, especially from an ergonomic point of view: transport of the prototype, quality of the sound, and human-machine interaction. But the project essentially focused on reducing the costs of the technology and the service, so that it would match the insurance company's estimations. An Assurtous call centre was in the frontline of interactions with patients so that the medical staff's workload could be reduced.

The experiment concerned diabetic patients, with a view to accelerating their return home after hospitalization. It was based on an economic justification: a reduction in hospitalization costs. A total of 15 patients used the device for three months. The analysis of activity and uses was less important here

than in the preceding phase, with objectives more geared towards testing the prototype with regard to the savings achieved by the hospitalization service.

This experiment with Assurtous ended early in 2005. The results were considered conclusive. According to the reports, patients left hospital on average 22 days before the expected date, and hospitalization costs were reduced by 50%. Hence, the system's economic value was fully endorsed, owing to the involvement of the business units and to the partnership with the insurance company.

Another experiment was run for a French hospital, where the system was introduced to monitor dialysis patients. The patients had to do their own dialysis every four hours and note down certain data (weight, etc.) in a logbook which they then took to the dialysis service every month. At each visit, the patients were examined and the data in the logbook were checked. These checks enabled the dialysis service to monitor the patients (quality of the dialysis, risk of infection). Finally, during these visits the medical staff and the patients examined the procedure together, so that self-dialysis could be practised safely.

Furthermore, a new experiment was launched involving dialysis patients. The service defined by the project team was intended to improve data management by enabling the patient to key the data for every dialysis (weight etc.) into a website. If the data provided by the patient indicated any danger (weight gain due to bad flow of the filtering liquid, risk of infection), the staff could call the patient at home on the videophone. The videophone enabled the nephrologist to perform an initial examination of the patient by examining the critical points that could lead to an infection.

The experiment was used to explore value in three respects: avoiding hospitalization by early detection of infection; providing patients with a feeling of security, and thus encouraging them to agree to go home with this type of dialysis, which in turn reduced hospital stays; and a reduction of the time needed for the hospital service to teach patients self-dialysis. Using a number of economic equivalences, such as the cost of hospitalization or of training patients, it was possible to build an economic equivalent of the benefits of the system.

The hospital involved started to re-appropriate the technology and considered using it permanently. It was however soon discouraged by the first commercial proposals which exceeded its available budget, with no financing available for this type of activity. It was therefore impossible to set a selling price acceptable to the HH services.

> *Bringing technology into health services is difficult for many reasons. Either one is in private practice and there one doesn't have the necessary commercial surface, or one is in a hospital and there one is in a*

domain where one has the public funding for which one has to have a lobby upstream to generate services. It's not by just going to sell this to a hospital service that we're going to manage. You have to go and see hospitals' financial services, provide for the budget in advance, it's very complicated. So in both cases, we really weren't formatted for that. So we couldn't get anywhere with this. (Manager, R&D Health)

3.3.2   Valuation by the business unit based on expert interviews

The project was transferred to a business unit responsible for identifying markets and funding new developments. A marketing and sales team sought to identify the prescribers of this type of service within the hospital organization. They noted that the HH services did not have the budget for this type of activity. It was therefore necessary to persuade institutions in charge of health policy: the *Caisse Primaire d'Assurance Maladie* (national health insurance fund) or the *Agences Régionales d'Hospitalisation* (regional hospitalization agencies). These institutions were responsible for establishing the modalities of hospital activities, including the development of care networks or the HH. The sales team interviewed these new spokespersons and questioned them on value and pricing. The value thus identified and the price these organizations were prepared to pay for it was nowhere near the price envisaged for the service by the marketing team.

The interviews concerned both the functionalities and the "value" aspects (especially the willingness to pay), and were to serve to define a target price. This work was twofold: first, proposing price ranges to the experts, or getting them to propose such a range; and second, attempting to get the "experts" to measure and quantify the economies and/or benefits generated by this system. The business unit reasoned in terms of "costs avoided" to address the benefits of the solution for the customers.

The interviews with the experts were biased by the wish to commercialize the existing device and not to discuss its functionalities and value. The underlying assumption was that "the market already exists", in the sense that today these customers would benefit from buying and using the device. However, the experts had great difficulty in answering these questions as the offer was too innovative; they had no references in the market. They were not convinced of the value of the videophone, yet it was the most expensive part of the system. The experiments did not really satisfy the evaluation as performed by the "prescribers", that is, the health funds and the agencies. What hospitalization cost reductions and what monitoring did the system enable? What possible reduction of medical staff's and caregivers' physical presence with the patients? What reduction of medical risks? The evidence did not seem to be sound enough to imagine a reorganization of the HH that would justify the investment.

Yet, during the interviews, on the fringes of discussions on a target price, the information obtained from the experts highlighted needs that until then had been totally under-estimated. The experts in charge of the care networks' policy and the HH were concerned, like the hospital services, by the computerization of patients' medical files. Given the network functioning of the HH, the computerization, consultation and informing of patients' medical files by various independent professionals was a priority. The project consequently evolved towards an entirely different perspective. Videophony was no longer the central functionality of the service; it was perceived as "an extra", a possible option in the medium and long term, which could be added to a computerized system of patient-file management. This would facilitate interactions between professionals, especially the general practitioner.

3.3.3 A custom-made offer driven by the customer demand

In parallel with the evaluation of this technology offer, the business unit asked the R&D division to develop "customized offers", that is, to carry out development projects in close collaboration with a customer, with a view to meeting its immediate needs. The dialogue was far more direct and the issue of economic value was central. Within this framework, the business unit worked with an integration service provider on a solution concerning the shared management of patient medical files. Home hospitalization required a substantial exchange of information between professionals, especially around medication prescriptions, communication on the diagnosis, and all other essentially written information. Unlike the previous system, the new one did not use videophony. The key actor in the management of patients' medical files was the family doctor, who had been completely left out in the design of the preceding device.

Although this customized offer was a success, its development was costly and was not recovered by this first action. The work consisted in developing a "generic" offer based on this specific offer. Note that there were already a large number of competitors. The prototype developed in-house for generic use (with the videophone) was discontinued and the focus switched to the prototype based on a customized offer (shared management of the patient file).

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4 Discussion

4.1 Plural and evolving modalities of valuation

The first lesson learned from the VisioHH case concerns the wide diversity of modalities of valuation adopted at one time or another in the innovation's trajectory. Table 1 below sums up a set of contrasting modalities which appeared in the various phases that we examined.

Project phase	Formulation / approach / method	Value or non-value element highlighted or used
Ethnography and focus group in the early phase	Projection of uses in situations of professional activity and identification of potential benefits. Evaluation and critique of use scenarios by the focus group participants; creativity with regard to alternative functionalities.	The nurse contributes to the remote diagnosis: She can show the wounds to the HH doctor = increased reliability and less time spent explaining. Reduction of travelling, better assessment of the patient's general condition, better reactivity in case of emergency. Reassuring the patients and, to a lesser extent, the nurses.
Experiments	Interviews with the stakeholders in the experiment; analysis of the professionals' activity indicators.	Qualitative evaluation: Organizational benefits (team cohesion, quality of collective work), more involvement by doctors in the diagnosis, benefits in terms of care quality. Disorganization of the HH: the system encourages patients to call at any time. Telephone interaction remains more practical for the nurses.
	Clinical evaluation methodology. Comparison of medical indicators between the patients who benefited from the Visio and those who did not.	The experiment shows a psychological benefit for the patients who have the videophone, but the scenario of reorganization of visits is not tested, which does not allow for gains in terms of reducing visits to be confirmed.
Groups of experts	Perspective of prescribers and deciders in partner organizations and administrations.	Reduction of hospitalization costs. Reduction of medical and caregiver presence at the patient's home. Reduction of medical risks.

Table 1: Modalities of valuation of innovation at the different stages of the project

As the table suggests, the various value elements identified in these different stages can be related to several phenomena. First, as we have seen, the technical definition of the project evolved (appearance and disappearance of functionalities), which changed the affordances for operations of valuation of the innovation. Each technical device involved the production of potentially useful effects specific to itself. Second, the formats of evidence used at each stage were different: for example, the medical evaluation and the socio-organizational perspective, both mobilized at the experimental stage, led to very different ways of assessing the benefits of the system. Third, the various trials each tended to favour the point of view of a specific actor or group of actors. Yet in so far as the innovation was offered to an organization, that is, a collective, the various actors concerned did not have the same activities, and therefore did not use the device in the same way, consequently not recognizing the same possible "useful effects".

These three dimensions have their own time dynamics, which constitute specific challenges for the project team's steering of the innovation. The first dimension concerns the development of the innovation: the transformation of the technical definition of the project results from the gradual exploration of the range of possibilities as the project unfolds. For the second dimension, the approach is limited by the fact that the trial formats applicable to value the innovation cannot be mobilized in a random order. Experimenting, for example, is possible only in so far as there was already a prototype, otherwise it is necessary to stick to approaches such as focus groups. Likewise, the refined testing of a business model implies that the relevant functionalities have been identified. For instance, in the VisioHH case, the functionalities linked to the sharing of information from the medical file were identified at a late stage, and an economic analysis at the start of the project would probably not have been able to account for the added value that they ultimately represented.

Finally, the third dimension can constitute a particularly complex source of variability in valuation modalities. As the VisioHH case clearly illustrates, once again, the list of actors involved in the innovation is not necessarily available in advance, and it changes along the way. The implementation of a technical-organizational innovation includes a process of exploration of recipients, which has a performative dimension. The recipients are not characters who are already there, no more than they are totally constructed by the device. The innovation can contribute to defining their activity to the extent of modifying their role and identity. In certain cases they may also be particularly active in the design of the device, using the technological project as a lever to develop their own role (Reverdy, 2005). In the case studied here, the recipients changed from one phase to the next: initially the nurses were targeted; the

doctors appeared to be central in the operational phases; and the financer came to the fore in the marketing phase.

This case study draws attention to two other points. First, the evaluation process can lead to highly contextual results in the trials implemented. For example, the actors' motivations in the experiments introduce a bias of representativeness. We have seen that the testing of videophony in the hospital service was instrumentalized by the doctors for medical research purposes; their investment in the experiment was therefore due to their own personal publication strategy. On the other hand the nurses had a marginal role in the experiment even though they were expected to be the main users; they encountered problems taking up the technology, which were ascribed to the experimental situation. Second, the diversity of use situations studied and prototypes tested does not always make it possible to validate them as a generic solution. Each experiment encounters a specific organization with different problems, and facilitates the development and testing of more or less specialized functionalities. Due to the conditions in which they are carried out, and the many biases associated with the efforts to mobilize actors, the trials (especially in-house experiments and pilot phases) are often more relevant to the validation of techniques and of user ergonomics than to the validation of functionalities.

4.2   Organizational dynamics and the aggregation of evaluations

The plurality of forms of valuation, depending on the actors concerned, is not *per se* abnormal. However, as we have seen, this plurality is exacerbated when the service is targeted at an organization, and is a challenge for innovators who have to find a way of articulating the different perspectives. This reflects two types of question concerning the way in which forms of convergence can be produced between the different valuations by mobilizing the dynamics of the target organization. To what extent is it possible to go beyond the differences of format or of point of view to put several valuations on an equal footing, based for example on translation processes that exist or can be activated in the organization? To what extent can the organization itself contribute to establishing forms of aggregation or prioritization on which innovators can rely?

When it comes to information systems, this question traditionally focuses on the bipolarity between the end user and the procurement decision maker in the targeted organization. Everyone has different objectives: deciders do not use the service but, as they pay for it, they often expect the innovation to have tangible useful effects in terms of "returns on investments". Users do not pay but other variables such as comfort and user-friendliness are important to them. Hence, the link between valuation and

successful innovation will often be addressed by innovators in the following way: as implementing a service that one is not sure will be accepted by users stands the risk of refusal, one has to be sure that from the end user's point of view there is a perceived value; conversely, having the employees' agreement but not that of the decider in the organization will not ensure that the service is purchased. We see how the two questions raised above articulate: even if they assess the benefits of the system from their own perspective, deciders have to understand what gives it its value for the final user; but the organic ties that they maintain in the organization with the final user can cause them to prioritize certain forms of evaluation over others – the decider may for example act on behalf of the organization's management, which has little concern for the end user's comfort and aims rather for productivity gains, about which the users are indifferent. The VisioHH case shows the importance of these questions while highlighting their complexity in real situations – a complexity concerning three dimensions in particular.

First, it seems necessary to transcend the dichotomy between the decision to invest and usage, and between the two forms of associated valuation: the evaluation of benefits for the organization, often carried out by the actors in a decision-making position, and the benefits for the users *per se*. There may be more actors and, in the innovation situation, they may occupy positions that do not match the decider versus user opposition. The roles to take into account may be complex: one need only look at the ties between nurses, HH doctors, patients, family doctors, and financers in health agencies that we see in the VisioHH case, to get an idea of the extent of this difficulty.

Second, while the "decision-making" actor seems to play an essential role in the system of relations at play here (ultimately he will give the go-ahead), it is not always easy to identify and especially to understand how other actors weigh in on the decision that he or she takes. In the VisioHH case, we may have the impression that the project team took a long time to realize that the "HH doctor" actor was not the real decider, nor one who was in a position to weigh in heavily on the choices that the managers in funding agencies and hospital administrations would make.

Third, the analysis of the position occupied by the decider can waver between two conceptions of the valuation process entrusted to him or her. The first conception holds the decider as the actor *par excellence* to be in a position to grasp, globally, a "value of the innovation for the organization". This version is somewhat idealized, in so far as the benefits of adopting a new communication technology are an organizational construction, the result of which is difficult to anticipate. These benefits depend as much on the tool's basic functionalities as on its settings and adjustments to actual practices, to changes in the practices themselves and their reorganization, and to the way in which these changes are

evaluated by a set of deciders. They cannot easily be identified upstream by relying only on individual evaluation experiences, for talking of individual useful effects is not enough to qualify a useful effect for the organization as a whole. For example, noting that a patient can interact more serenely with a nurse via remote communication is not enough to justify a large investment in a videophone system.

In the second conception we consider, more realistically, that the decider grasps the value of the device in relation to his or her own reference framework for evaluation. In the position that he or she occupies, this framework will often be expressed in terms of costs and performance of a system involving organizational changes. In the present case, the deciders in a position to invest belong to national and regional agencies that organize the hospital offer and care networks. They assess the value of the technical device with regard to the benefits in terms of quality of the monitoring and care, and of the reduction of risks and of costs of visits or re-hospitalization – benefits that will be estimated on the basis of different scenarios of care reorganization. As regards public health, various calculation techniques highlight the benefits identified. For example, a reduction of the risks of re-hospitalization can be equated with a reduction of the costs of hospitalization by means of various formulae and statistical calculations that experts in the economics of health use. The evaluation of these benefits can be informed by the useful effects that have been identified at different phases of the project. For example, the project actors tried to show that the quality of the interactions made possible by the videophone afforded a reduction in the number of visits to patients' homes, and facilitated the return home of patients who would otherwise have remained in hospital.

"Exploring the value of the innovation for the organization" therefore implies, not so much seeking an improbable overarching position in which all the organizational implications can be encompassed, as establishing such organizational change scenarios in a sufficiently robust way, and translating them credibly into indicators of value. This work of identifying scenarios and translating and establishing equivalence is generally carried out by the innovator as much as by the actors of the recipient organization. It is of course undertaken initially with many assumptions and approximations on all the elements of the chain linking the local uses of the device to the estimations of benefits. As the experiments unfolded, and with the involvement of the various actors of the "recipient organization" (a term that must not be limited to the hospital, but be understood as embracing all the other partners such as doctors in private practice and private health insurance schemes), the project was able to clarify these assumptions and thus converge towards a set of coherent scenarios.

If the benefits measured are dispersed in the customer organization, if the benefits for users cannot easily be translated into benefits for the decider, if the translations are fragile because based on assumptions that are difficult to verify, then the identification of a benefit by the decision maker will be uncertain. In the case studied here, many experiments and evaluations were carried out without any real identification of the actors able to make the investment. The various scenarios studied were rarely associated with a calculation of the benefits that could potentially convince such a decision maker. It was only much later, when the project had already advanced substantially (the technical developments were largely complete) that such estimations started to be formulated. The difficulty essentially stemmed from the fact that many of the translations between values were a result of experimentation. It is not easy to credibly translate a benefit in terms of trust and quality interaction between a patient and a nurse, based on the reduction of the number of visits, without experimenting.

Finally, exploring implies envisaging a diversity of scenarios. It is at the heart of the "value analysis" approach proposed in project management. The aim is to associate with each functionality a device representing an option, each of which has a value for the user and a production cost. The exploratory approach then results in the decision to jettison those options for which the value does not finance the costs. This type of approach implies a strong articulation between the technical expertise, which describes the scope of possible options, and the market experts, who can test these options one by one.

4.3 Estimating the value for the provider at the risk of overlooking customer value

We have seen that the analysis of the customer value relates to a plurality of actors in the recipient organization. But we should also note that the assessment of value is also spread across the supplier organization. The service provider likewise proceeds by evaluating what the innovation can provide for it, influenced by its own organizational structure and exploratory practices. Our inquiry confirms a finding already reported in the literature: innovation feeds on internal friction between actors with diverse competencies (Stark 2009). Conversely, innovation can suffer from too much sequentiality between the different valuations.

In our case studied here, the value of the project as estimated by Télécom 2000 was associated for a long time with the objective of finding markets for the videophone, in the development of which large investments had already been made. That was originally the project rationale. Home hospitalization was identified as a potential place for the use of the videophone. This strategy, often qualified as

"technology-push", has some legitimacy: using existing technologies has the advantage of extracting value from that which already exists, and ensuring good control over its development. Hence, we observe a large degree of sequentiality between an exploration of value, primarily by the technical teams, concerned with technical issues, and a valuation conducted by the marketing actors. During the various experiments, the project team had no idea of the overall cost of the service, which included the recouping of the investments in development, as well as costs related to the service and to its commercialization.

The customer's difficulties in exploring value, which we highlighted in the preceding section, can resonate with the weaknesses of the internal construction of value. In a context of significant uncertainties with regard to organizational scenarios and the "aggregated" benefits for the recipient, the exploratory process was guided by other motives. The work of scripting the future organization and of translating the local benefits into "global" benefits contained so many uncertainties that the various affirmations were easy to manipulate.

In the case studied here, the initial rationale of the project, "using videophony", was imposed as the framework of interpretation of the many trials organized by the project team. The relevance of videophony in relation to its ultimate cost was hardly questioned, for if it were, the project rationale would have disappeared. "Videophony" was an unavoidable component of the project. The experiments brought to the fore many simple technical solutions to facilitate home hospitalization and avoid many trips, without introducing videophony (photos, daily inputting of diabetics' test results, etc.). Yet the project team tended to disregard these conclusions because it could not allow itself to endorse results that undermined videophony. Rather than exploiting these findings and diversifying the scenarios, it maintained its initial technical and organizational assumptions.

> When you say to someone: "here's a Ferrari, is it nice to drive?", it is unlikely that anyone would say no. However, when you return to reality, you rather buy a Twingo. The problem is knowing how we go from the Ferrari to the Twingo. Unfortunately, I think it's something that wasn't envisaged very well." (Project Manager)

The many uncertainties and ambiguities associated with this work of aggregation of benefits are therefore fertile ground for the "mechanisms of engagement" that lead us to persevere in certain choices when many warning signs encourage us to work with other assumptions (Ross and Staw, 1993). Internal "valuation" affects what the project team can retain from each trial, at the risk of not hearing the expression of values in contradiction with its own, and of remaining blind to other actors'

expectations. Given the various situations of "valuation", the ambiguities and misunderstandings are numerous. It clearly appears, with this case, that the technological investments in videophony forced the project actors to envisage the project with this technology only. Yet elsewhere, experiments showed that it was possible to envisage the use of many other technical resources in which the firm was equally competent, and that offered greater benefits to the customer at a lower cost.

Throughout the exploration process, the experiments provided enough signs to advance in the assessment of the various functionalities' value. But the lack of support from the business and marketing departments hindered this progress and prioritization in the innovation's development. Conversely, the business and marketing departments' intervention was based on a pre-existing system, with predetermined components, costs and functionalities. The exploration was sequential: technical first, commercial and economic afterwards. This sequentiality reflected the organizational structure. It prevented the achievement of an "analysis of value" that would imply the parallel exploration and valuation of the various functionalities.

Many firms have perceived the danger of identifying aggregated benefits too late, and of evaluating them too late. Building a "business model" is often seen as a way of avoiding this type of danger, and should be done as early as possible in the process. It has often become the necessary condition to obtain funding for developments. This injunction can nevertheless paralyze developers who do not always have the means to identify the various scenarios and equivalences that might allow for this aggregated benefit to be achieved. The business plan is considered as a necessary step to "sell" the project to the business units; it is not used as a tool for exploring value while the project is under way, in parallel with technical developments. The R&D project leaders lack the marketing skills and expertise necessary for the valuation that should accompany any exploration of technical functionalities. On the marketing side, the temptation is great to construct this "business model" by analogy with comparable propositions: the offer of value will seem credible and rigorous. But this may have the effect of preventing more radical innovations for which there are fewer data and formulae for comparison.

During the design process, it is possible to produce business models with different levels of refinement, depending on the phase in the process. Reflection in the early stages of the project may be limited to a representation of the ecosystem and to the way in which value can both be created and captured by the various actors, in such a way that it can fit into a logic of interessement.

5 Conclusions

Beyond the necessity to have a methodology to measure value at different stages of a process, innovators are often faced with various expressions of value, especially since this dimension is considered at different stages of an innovation trajectory. What does the VisoHH story teach us about the process of exploring value?

It shows, firstly, that there is a fundamental difference between "functionality", "useful effect", and "value". The project team very efficiently identified the "useful effects" of the technology, throughout the project, owing essentially to the many observations of practices and the different experiments. On the other hand, it experienced the most difficulty when it came to switching from "useful effects" to "value".

Secondly, this story suggests that a good articulation between the value perceived by the recipient and the value for the project team is required. Here, value was primarily defined in-house, in relation to an R&D team's strategic objective of finding applications for a technology without use: videophony. This point of view was not critically articulated with customer value as qualified by the innovation recipients. The attachment to this technology biased much of the efforts to interpret the experiments, as well as the design choices and investments in technology.

Thirdly, the story shows that to switch from the different useful effects expressed, and from values expressed locally, to the adoption of the technology, a process of aggregation of the "useful effects", of ranking, and of calculation is necessary. The actors of the VisioHH project were unable to do so, due to a lack of interaction with those who were in the best position to define value legitimately, that is, the potential financers of the device. The work of translation between "useful effects", "values" expressed locally, and "medico-economic" value was undertaken very late. Far less support and in-depth work went into this translation than into all the work undertaken in the early stages. Yet it was decisive.

Finally, the customized offer that was made at the end of the project was guided far more closely by the "medico-economic value". The device was far less costly and less sophisticated, and the functionalities and added value far easier to establish and to defend. Yet it corresponded to many needs that had already been envisaged throughout the experiments with videophony, and that did not relate to videophony. Does the exploration of value not imply temporarily giving up, in a way, at least the assessment of value for its own sake, so as to better share others' own construction of that value?

6 References

Callon, M. 2009. La formulation marchande des biens. In *Evaluer et valoriser. Une sociologie économique de la mesure*, ed. Vatin, F., 248-269. Paris: Presses Universitaires du Mirail.

Charue-Duboc, F., F. Aggeri, V. Chanal and G. Garel 2010. *Managing exploratory innovation*. Paper presented at Communication to the "2010 European Academy of Management Conference; Track: innovation into the future", in

Chesbrough, H. and R. S. Rosenbloom 2002. The role of business model in capturing value from innovation: evidence from Xerox corporation's technology spin-off companies. *Industrial and Corporate CHange* 11, 3: 529-555.

Ciborra, C. 2001. A Critical Review of the Literature on the Management of Corporae Information Infrastructure. In *From Control to Drift. The Dynamics of Corporate Information Infrastructures*, ed. Ciborra, C., 15-40. Oxford: Oxford University Press.

De Vaujany, F.-X. 2003. Les figures de la gestion du changement socio-technique. *Sociologie du Travail* 45, 516-536.

Garel, G. and R. Rosier 2008. De la valeur client à la valeur amont. Management de l'exploration et analyse de la valeur. *Sciences de Gestion* 64: 43-58.

Kjellberg, H., A. Mallard, D.-L. Arjaliès, P. Aspers, S. Beljean, A. Bidet, A. Corsin, E. Didier, M. Fourcade, S. Geiger, K. Hoeyer, M. Lamont, D. MacKenzie, B. Maurer, J. Mouritsen, E. Sjögren, K. Tryggestad, F. Vatin and S. Woolgar 2013. Valuation studies ? Our collective two cents. *Valuation Studies* 1, 1: 11-30.

Lamont, M. 2012. Toward a Comparative Sociology of Valuation and Evaluation. *Annual Review of Sociology* 38, 1-21.

Le Masson, P., B. Weil and A. Hatchuel 2006. *Les processus d'innovation. Conception innovante et croissance des entreprises*. Paris: Hermès.

Orlikowski, W. J. 2000. Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science* 11, 4, july-august 2000: 404-428.

Reverdy, T. 2005. Les normes environnementales en entreprise : la trajectoire mouvementée d'une mode managériale. *Sociologies pratiques* 10: 97-119.

Ross, J. and B. M. Staw 1993. Les normes environnementales en entreprise : la trajectoire mouvementée d'une mode managériale. *Academy of management journal* 36, 701-732.

Segrestin, D., J.-L. Darreon and P. Trompette 2004 *Le mythe de l'organisation intégrée. Les progiciels de gestion - Revue Sciences de la Société n°61*. Toulouse: Presses Universitaires du Mirail.

Stark, D. 2009. *The Sense of Dissonance. Accounts of Worth in Economic Life*. Princeton, NJ: Princeton University Press.

Trompette, P. and E. Blanco 2009. L'usage en conception. Projeter sans fermer la carrière sociale des innovations. In *Comment les acteurs s'arrangent avec l'incertitude*, ed. Chalas, Y., C. Gilbert and D. Vinck, 97-116. Paris: Edition des archives contemporaines.

Veyrat, N. 2008. Les usages dans la lunette. Co-concevoir des produits et des usages innovants. Université Pierre Mendès France de Grenoble.

Woodruf, R. B. 1997. Customer Value: The Next Competitive Advantage. *Journal of the Academy of Marketing Science* 25, 2: 139-153.