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PROPOSAL OF A RADICAL INNOVATION PROJECT SELECTION MODEL BASED ON PROOFS OF VALUE, INNOVATION, AND CONCEPT

B. Zimmer, B. Yannou and J. Stal – Le Cardinal

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1. Introduction

In different entrepreneurship or intrapreneurship situations, there are times where a more or less developed idea or concept must be presented and evaluated by investors to raise public and/or private funds in order to move up a step in the development of a new product and/or service (the process of maturity of an idea or a research project, or go/no-go of a detailed design phase). Yet, currently, no clear method exists to select ideas or concepts with a strong potential for success in the market in the context of a start-up or of an existing business. There is engineering design literature that emphasizes idea generation processes, but outside of the context of business and industry. There is also management science and technology management literature that emphasizes mainly factors external to the innovation project. The success of the innovation project in the market will be based upon these factors, which are generally measured by experts using a business plan. But there exists little or nothing to evaluate the more or less great potential for success in the market of a radical innovation concept or idea presented to a jury of experts. A radical innovation methodology, called Radical Innovation Design® [Yannou et al. 2011] was recently proposed for multidisciplinary and business contexts, in order to maximize the potential for success of a radical innovation in a business context. This approach proposes the use of three groups of proofs: proofs of value, proofs of innovation, and proofs of concept, proofs that "solidify" throughout the phases of problem setting and concept design. The article [Yannou et al. 2011] shows that there is a strong conditional probability between effective value creation and the contribution to solidification of proofs during the problem setting and concept design phases. In this article, we propose a radical innovation project selection model at different stages of progress (ideas, concepts, prototypes) for projects with a strong potential for success in the market. We propose a chart with 22 pieces of evidence of value, innovation, and concept, to be used in two stages in a selection procedure by two innovation juries made of experts from numerous disciplines. The two stages aim first to eliminate the low utility and low innovation projects and then to eliminate the low profitability and low concept performance projects. The first stage focuses on the interest and the potential of the problem, whereas the second focuses on the early results of the proposed solution. We applied and tested the effectiveness of this model on two juries of innovation experts consisting of 20 individuals with radical innovation project expertise, with the most promising projects given funding and/or support by service providers from a cluster of businesses and organizations with competency in gerontechnology. Our selection model is made up of a procedure and a chart. It offers three advantages. First of all, it makes it possible to more effectively finance projects with high potential for success in the market based on the evaluation of proofs of value,

innovation, and concept. Secondly, the chart that we propose has shown that it gives a clear frame of reference in order that the experts from the juries might develop a more collective vision of the expectations of a radical innovation project. Finally, the results of our satisfaction questionnaire, individually administered to the experts after their testing of our model, show that the procedure we are proposing is effective. Firstly, it gives structure to a discussion on the interest of allotting funding and/or support to an innovation project. Secondly, the use of an evaluation chart allows the experts to create a common language in order to measure the success of a radical innovation in the market.

2. Literature review of selection methods for radical innovation projects

Our study is focused on radical innovation, which is, according to [Garcia and Calantone 2002], innovation that does not answer expressed needs, but that rouses a demand that was not first articulated by the users before launch. These innovations are therefore riskier and more uncertain than incremental innovations [Boly 2008]. These ideas are born of a creative process largely described in the field of engineering design. According to [Shah et al. 2000], the literature in the domain of engineering design suggests that "*a wide range of formal methods have been devised and used for idea generation in conceptual design. Experimental evidence is needed to support claims regarding the effectiveness of these methods in promoting idea generation in engineering design*."In this field, the literature focuses more on the creative process and the exploration process that make it possible to produce a concept that creates the most value, and it focuses less on the scheduled launching of a new product and/or service into the market in a business context. According to [Wadell et al. 2010], the upstream phases of the innovation project are the discovery of an opportunity, analysis of this opportunity, generation of an idea, selection of an idea, and definition of a concept. An innovation process that transforms an innovative idea into a new product and/or service that sees a relative success in a market has barely been touched upon. In our study, we are seeking to know if we can measure the potential for market success of a new product and/or service as early as the upstream phases of the conception of an idea, concept, or first prototype. This question is addressed more in innovation marketing and technology management literature, where the authors [Astebro 2004], [Cooper 2001] consider that the goal sought is the probability that a new idea reaches market rather than simply being "innovative". These authors propose innovation management methods to direct the selection process and the process of transforming an idea into a successful scheduled launch of a product into a market. [Cooper 2001] proposes a method, Stages and Gates®, that models the innovation process systematically and sequentially, beginning with the phase of discovery of an opportunity and terminating with the scheduled launch of a new product. The probability of success of a new product and/or service in a market is described as the culmination of a harmonious synchrony of these "stages" and "gates". [Astebro 2004] proposes a prediction model of the factors of success or non-success of an innovation project, based on the identification of 36 criteria. This model predicts the relative success, to 80.9%, of an innovation project, but it is for incremental innovations. In the end, these methods and models seem to be well-suited to existing businesses that are equipped for R&D in an operational mindset and that realize incremental innovations. However, they seem less suitable for radical innovations tied to a mindset of exploration, headed by entrepreneurs, often on their own, where the market is known for its complexity and uncertainty. These methods and models offer reference points to formalize and finalize the drafting of a business case while the business wishes to innovate in an incremental manner, but they do not measure value, innovation, or concept potentials of a radical innovation project drawn from need, as proposed by the Radical Innovation Design® methodology [Yannou et al. 2011]. In this publication [Yannou et al. 2011], the authors demonstrate that this methodology solidifies the proofs of value, innovation, and concept throughout the innovation process from the framing of the problem – problem setting – to its resolution – problem solving. Using these three types of proofs is very effective in the secure direction of the development and launching of a radical innovation; [Yannou et al. 2011] have shown that there are strong conditional probabilities between creation of actual values and the contribution to solidification of proofs during the phases of problem setting and conceptual design. This methodology is complementary to the SynOpp® method in innovation management [Filion and Ananou 2010]. This method dynamically formalizes, builds, and measures a business case, an aid to the three types of proofs in the Radical Innovation Design®

methodology [Yannou et al. 2011]. SynOpp® allows the entrepreneur and the expert to follow, guide, and assess the creation of opportunity from its origins to the beginning of its exploitation. The business case is created in order to assemble the studies that demonstrate that the project owner is capable, that the environment is ready, and that the project is innovative. These are also the three conditions addressed in the [Millier 1999] model that lead to innovation projects. SynOpp® reconsiders the business plan, criticized more and more by investors for radical innovations for which, by definition, we cannot go by an experience from the market to correctly foresee extrapolations of new market areas. The business plan allows the investor to measure the relationship between the project owner, the opportunity, the context, and the risks in which the project is developed [Sahlman, 1997]. A business plan defines the concept, market, business model, marketing plan, product development plan, action plan, project team, risk analysis, and financial projections including R&D investments [Abrams 2003], [Sahlman 1997].
Finally, we keep in mind that there are selection methods for incremental innovation projects in the fields of marketing and innovation and technology management. There are also methods to support or predict the success of a new incremental innovation project in the market. We show that existing tools, such as the business plan, are not sufficiently suitable for measuring and demonstrating the potential for success of a radical innovation project in the market. Finally, we note that new methods have been developed for creating a business case. However, we note that these methods do not explain the radical innovation project selection procedure enough, nor do they sufficiently explain the role of the experts who analyze these business cases.

3. Proposal of selection model for radical innovation projects

3.1 Our research hypotheses

The radical innovation project selection model that we propose consists of a procedure and an evaluation chart to measure evidence of value, innovation, and concept. This model is based on 3 hypotheses.
The *first hypothesis* is that the value, innovation, and concept potentials of an idea can be partially recognized very early, as soon as the emergence of the idea, without yet having a concept in view. This is made possible by the formation of a body of proofs of value, innovation, and concept that are more or less verified by usage, test, marketing, legal, technical, financial, commercial, and managerial analysis studies [Yannou et al. 2011]. It is the logical combination of these three types of proofs (of value, innovation, and concept) that will reveal a potential success in the market for an existing business or a start-up in the process of being created.
The *second hypothesis* is that the value, innovation, and concept potentials of an idea can be expressed using proof, i.e., information that demonstrates the reality of a fact, a state, a circumstance, or an obligation. Proof consists of a set of evidence that we consider to be intermediate design objects. According to [Jeantet 1998], they are intermediate studies, analyses, experimentation, interviews with experts, models on which are based the choices of projects, and the concepts reached in the end.
The *third hypothesis* is that the value, innovation, and concept potential of an idea can be partially revealed very early by a multidisciplinary diagnosis carried out by innovation and market experts, based on an innovation feasibility study report. This diagnosis must be supported by an evaluation chart that contains the set of evidence of value, concept, and innovation. In fact, on the other hand, if no proof of creation of value (it is useful and profitable), of patentable innovation, or of concept (it functions effectively in the expected conditions, the concept can be industrialized at a controlled cost, there are clients ready to buy it) is present, then we have the right to have serious doubts about the probability of success in the market for such an idea or concept/prototype.

3.2 Proposal of radical innovation project selection procedure

Figure 1 presents the radical innovation project selection procedure at different stages of maturity (ideas, concepts, prototypes) that have a more or less great potential for success in the market. This selection procedure must allow an individual investor (such as a venture capitalist) as well as a public or private investment organization (such as a cluster) to select an innovation project for which the

potential for success in the market is measured based on the level of maturity (i.e., the level of completeness and certainty) of the evidence of value, innovation, and concept that it presents. This procedure is used in two stages as proposed in the Radical Innovation Design® methodology [Yannou et al. 2011]. These two stages allow two juries, consisting of experts from numerous fields, to filter the radical innovation projects. These experts are innovation and/or market specialists who come in at different milestones in the development of a radical innovation project. They might bring their services (advice, network) and/or invest financially to enable the development of the project. These experts have strong knowledge and skills in marketing (supply and demand), intellectual property protection, competitive intelligence, innovation (project management, action plan development, economic model development, knowledge of public and private financial aid for the encouragement and support of innovation, etc.), design, and economy. This procedure allows the experts to eliminate low utility and low innovation projects in the first stage (**"problem setting" jury**) and then to eliminate the low profitability and low concept performance projects in the second stage (**"problem solving" jury**). During the first stage, the experts measure the interest and the potential of the problem (Is it useful? Is it innovative? Are there gaps?), and during the second stage, they measure the first results of the proposed solution (Does the solution work in the anticipated situation? Can it be industrialized? Is it profitable for the business or future business?). Each circle, illustrated in Figure 1, represents a radical innovation project headed by an entrepreneur or a business. This project contains more or less mature evidence of value, innovation, and concept of an idea, concept, and first prototype. This "Stages and Gates" selection procedure is accompanied by an evaluation chart measuring all the evidence of value, innovation, and concept (see Section 3.3). Finally, Figure 1 shows that this selection procedure filters 3 types of radical innovation projects determined by the collective analysis executed by the two juries of experts. **"Success"** projects demonstrate to the experts that their body of proofs of value, innovation, and concept is complete and certain, using intermediate studies and satisfactory initial commercial results (such as the signature of a first order). The proofs of value, innovation, and concept are sufficiently mature to demonstrate a recognized potential for success of the future product and/or service in the market. These projects deserve a seal of approval. **"Potential"** projects capture the energy and attention of the experts as shown in the box in Figure 1. These projects show a good level of maturity in their body of proofs of value, innovation, and concept, but still insufficient to demonstrate a recognized potential for success in the market.

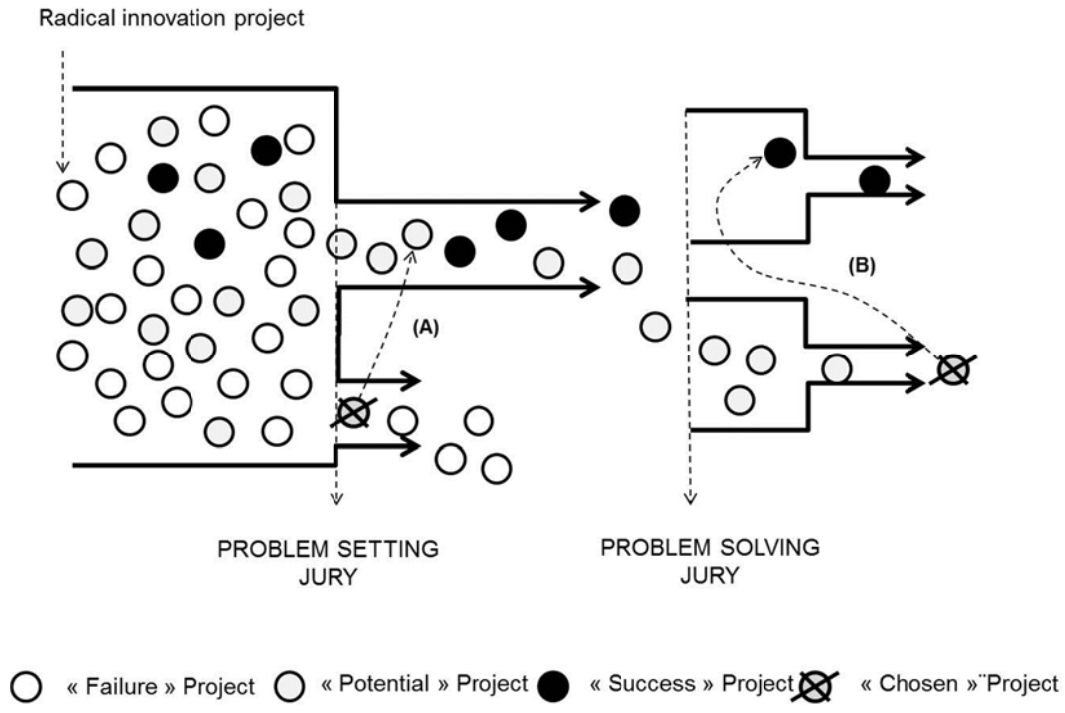

Figure 1. Radical innovation project selection procedure

They are innovation projects that deserve funding and coaching. **"Failure"** projects base their potential for success in the market on unfounded or even false evidence of value, concept, and innovation. These projects contain allegations that are neither detailed, nor verified, nor validated. These projects present no interest because the potential for success in the market is low or even zero. This selection procedure is original, because it offers three great advantages for innovation project selection: first of all, it is dynamic in its two types of filtration; secondly, as early as possible, it avoids ruling out an idea under the pretext that the proof of concept is not mature, while the potential of the proofs of value and innovation are very significant (**A**); finally, it offers personalized coaching to entrepreneurs for whom the project is classed as "Chosen" by the experts. This coaching allows entrepreneurs to be put in contact with service providers who will advise them in order to solidify lacking evidence of value, innovation, and concept of their projects (**B**).

3.3 Creating the evaluation chart of proofs of value, innovation, and concept

To begin, we participated in the assessment of more than 100 radical innovation projects in gerontechnology in the context of the Charles Foix research and innovation grant (the *Bourse Charles Foix*). It is one of the activities of the business and competency cluster Sol'iage (see Section 4.1). We then carried out a statistical study, based on our observation from the Charles Foix grant. We showed that the project owners' candidacy applications were incomplete in terms of proofs of value, innovation, and concept. We also showed that the experts differed in their assessments. At the same time, we met more than 20 specialists in innovation (regional innovation support organizations, regional business creation support organizations, venture capitalists, and recognized marketing, engineering, and innovation management consultants) and in the gerontechnology market (health professionals, provident societies, and autonomy funding organizations) during individual and open interviews. We were thus able to better understand their practices and their ways of judging radical innovation project selection material. We were also able to measure their expectations in order to optimize the innovation project selection procedure. We completed our work by carrying out a literature review on the factors of success that determine, more or less, the successful launch of a new product and/or service in a market, defined by [Astebro 2004], [Balanchandra and Friar 1997], [Cooper 2001], and [Porter 1998]. Finally, this set of evidence was classed into 3 types of proofs: proofs of value (utility and profitability), proofs of innovation, and proofs of concept. They were distributed according to the two stages of the radical innovation project selection procedure [Figure 1]. In the "**problem setting**" stage, the chart allows the experts to measure the proofs of utility and of innovation. The ***proof of utility*** proves that the idea, concept, or prototype is important for the user in terms of usage and in terms of emotional satisfaction. It shows that the idea, concept, or prototype could offer something for which the cost is acceptable. It demonstrates that there is potentially an opportune market segment. It consists of 5 elements: the *issue*, the *target*, the *usage*, the *ideal need*, and the *constraints* (legislative, legal, ethical, and economic). The ***proof of innovation*** proves that the idea, concept, or prototype presents a patentable and protectable level of innovation. This innovation offers a new service, welcomed by future users, comparatively to other existing products and/or services. This proof is used by the project owner to demonstrate that he can conquer or conserve new parts of the market compared to his competitors. This proof shows the expert that the project owner has sufficient knowledge to protect the exploitation of his innovation. The proof of innovation consists of 4 elements: *placement in the value chain*, *legal intelligence*, *techno-economic scouting*, and *places of innovation*. At this first stage of the selection procedure, the project owner will have proven to the experts that he has framed the project well, showing that there is a significant need and that it is confirmed by verified evidence. Then, in the second stage of our selection procedure, "**problem solving**", he must convince the experts that the idea or its concept is profitable and feasible. During this second stage, experts measure the production of the evidence of concept and profitability. The ***proof of concept*** proves that the idea, concept, or prototype works effectively in expected situations specified by simulations, by validations in situ, and by the design process that sometimes involves the users. It consists of 7 elements: the project *action plan*, the *concept description*, the *financial management* of the project, the *skills and knowledge* of the project owner, the *partners* of the project, a *risk analysis*, and a *validation process* for the different milestones of the project. The ***proof of***

profitability proves that the idea, concept, or prototype is profitable (brings with it benefits) in the context of creating a business or a future start-up. The relationship between the design cost of the product and the selling price is profitable for the business or the future start-up. The purchase price of the product relative to the service provided by the product is accepted by the user. It consists of 6 elements: the *distribution chain* of the future product and/or service, the *promotion strategy*, the *sales strategy*, the *return on investment* for the project owner, the *service provided for the user*, and the *service provided for the system of which the user is a part*. These 22 pieces of evidence of value, innovation, and concept are measured by each expert using a maturity scale that measures the level of completeness and of certainty of the evidence [Table 1].

Table 1. Proposed evaluation chart maturity scale for measurement of evidence of value, innovation and concept

Score	Definition of the level of completeness and of certainty
0	The piece of evidence is missing from the application.
1	The piece of evidence is relatively well presented in the application. But it is incomplete, difficult to interpret, or even misleading. Its level of certainty is low.
2	The piece of evidence is well presented in the application. It is practically complete and adds a real advantage to the study. It satisfies the area in question, but its level of certainty is average.
3	The piece of evidence is very well presented. It is complete and adds a real advantage to the study, especially as its level of certainty is high and demonstrated by many references (publications, letter of support from experts, experiments, etc.)

The construction of our evaluation chart finished with the setup of a workshop. The group of players interviewed participated in the workshop in order to validate the pieces of evidence of value, innovation, and concept that we defined. This evaluation chart offers two advantages: (1) It allows each expert to make his own argument in order to be able to defend the innovation project within the two juries of the selection procedure. (2) It is used by all of the experts as a common checklist that constantly reminds them of the set of expectations of an innovation with a high potential for success in the market, such as that of gerontechnology in our study.

4. Experimental protocol

4.1 Application of our model to the radical innovation project selection procedure of the Sol'iage business and organization with competency cluster (known as the Sol'iage cluster)

Sol'iage is a business and organization competency cluster that financially supports radical innovation projects headed by entrepreneurs as early as the phases upstream of the design of a new product and/or service in gerontechnology [Harrington and Harrington 2000]. Sol'iage started a radical innovation project selection procedure 8 years ago, in the context of the Charles Foix grant. This procedure detects radical innovation projects that have strong value, innovation, and concept potential relative to the pathological situations in healthcare that are not covered by existing products and/or services. Since 2004, Sol'iage, using funds coming from public and more and more private partners (more than 240,000 Euros invested in 27 winner projects), finances radical innovation projects that create the most utility in terms of health (improvement of comfort and quality of life, increase of the hope for a healthier life, decrease in entering dependence, decrease in public health costs) and economics (increase in revenue of an existing business or of a start-up). The Charles Foix grant is organized through a call for projects on the internet. Project owners download an application with which they formalize their evidence of value, innovation, and concept. These applications are then sent to Sol'iage via certified mail. Sol'iage subsequently calls upon experts from different disciplines to appraise the applications. However, the existing selection procedure did not seem effective until 2009, according to the experts. And, in fact, certain winning projects failed while non-winning projects saw relative success in the market. These radical innovation projects, that are sometimes not really innovation

projects, are different in their level of maturity, their motivation, their evidence of value, innovation, and concept, and the profile of their project owner. In order to evaluate them, a jury consisting of experts in innovation and the gerontechnology market was established. However, these experts do not share the same interest in and opinion of the projects for various reasons: weak understanding of the market and of technical feasibility, differences in their vision of innovation, desire for a quick and exponential return on investment, etc. They do not have a procedure and tool that allow them to make the best decisions and more effectively select radical innovation projects that present a strong probability for success in the market. They also wish to feel more involved, engaged, and understood using a common language and a shared understanding of the innovation project.

4.2 Testing our model: the Sol'iage cluster's call for projects

The Charles Foix grant steering committee allowed us to test our radical innovation project selection model for the 8th annual Charles Foix grant. The call for projects took place between April 2011 and October 2011. 23 projects were appraised and 20 experts in innovation and the gerontechnology market were called upon. The overall sum of the grant endowment was nearly 40,000 Euros.

4.3 The experts recruited during testing of our model

Table 2 presents a classification of the 20 experts, innovation and gerontechnology market specialists, who participated in the experimentation on our procedure and evaluation chart. These experts were recruited to measure evidence of value, innovation, and concept during the two stages of our selection procedure. They were distributed in the procedure in function of their area of expertise [Table 2].
We tried to duplicate the manpower in each of the categories of experts in order to allow for a greater objectivity in the results. 8 experts participated in both stages of our procedures in order to assure an effective follow-up on the decisions made in the first stage (problem setting).

Table 2. Presentation of experts recruited during the 2 stages of our selection procedure

Procedure stage	Type of expert	Number
Problem setting	Public support structure for innovation project creation	2
	Expert in industrial and legal protection	2
Problem setting and solving	Health professional	2
	Competitive intelligence expert	2
	Scientist specializing in gerontechnology	1
	Health insurer	1
	Sol'iage cluster innovation consultant	2
Problem solving	Venture capitalist	1
	CEO of leading company in the gerontechnology market	2
	Public support structure for start-up creation	3
	Pubic investor in innovation	2

4.4 Satisfaction questionnaire

We sent a satisfaction questionnaire by e-mail to the 20 experts at the end of our selection procedure that took place during the 8th annual Charles Foix grant (October 2011). This questionnaire was administered in order to address two objectives:

1. To measure the effectiveness of the selection procedure and the chart that we proposed to the experts in order to (a) individually measure the proofs of concept, innovation, and value of a radical innovation project and (b) express a common language within the 2 juries.
2. To measure the comprehensiveness of the chart elements, their affiliation with the three types of proofs (of value, innovation, and concept), and their effectiveness in selecting radical innovation projects.

We received 17 favorable responses. The questionnaire had 6 multiple-choice questions. 3 questions concerned measurement of the effectiveness of the selection procedure and of the chart proposed in

2011. 3 questions concerned measurement of the effectiveness of the selection procedure and of the chart proposed in 2011 compared to the previous years.

5. Results

In this article, we present only the results of the first three questions of our questionnaire [Figure 2]. Figure 2 presents the distribution of the responses to the 3 questions (Q1, Q2, Q3) asked of the 20 experts. Only 17 experts have answered. There are 5 possible responses: “no”, “a little”, “yes”, “absolutely”, “no answer”.

- Question 1 (Q1): Does the use of this selection procedure help you to better determine the presence of proofs of value, innovation, and concept contained in the Charles Foix grant application?
- Question 2 (Q2): Do you find the set of criteria in the proof evaluation chart to be exhaustive?
- Question 3 (Q3): Is the use of this proof evaluation chart necessary to prepare for exchanges with the other members of the juries?

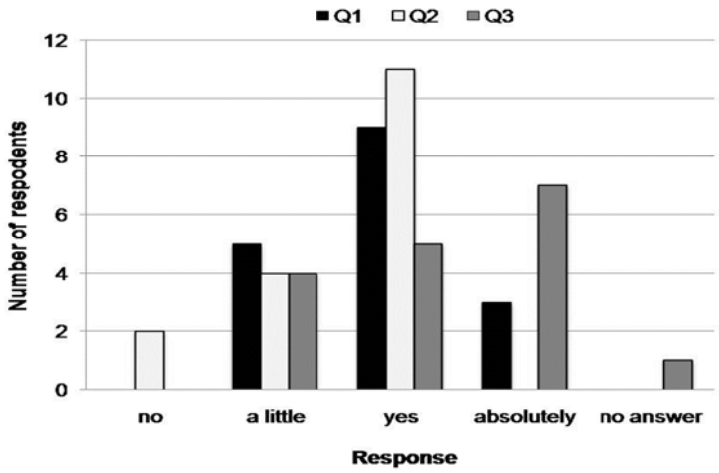

Figure 2. Results of the three questions (Q1, Q2, Q3) concerning the effectiveness of the chart selection procedure in 2011

Figure 2 shows that, on the whole, the experts appreciated the innovation project selection procedure for determining the presence of proofs of value, innovation, and concept contained in the application for the 8th annual Charles Foix grant. In fact, 9 experts (more than 50%) responded “yes” to question Q1. Figure 2 also shows that 11 experts said “yes” to question Q2. This result shows that the evidence of value, innovation, and concept in the evaluation chart seem sufficiently exhaustive for this group of experts in innovation and the gerontechnology market. This result seems to indicate that the potential for success of a new product and/or service can be seen as soon as the emergence of a new idea, without seeing a concept, with the help of an evaluation chart used by experts from different disciplines in the context of a procedure. Finally, Figure 2 shows that 12 experts were satisfied on the whole (the responses “yes” and “absolutely”) by the use of this evaluation chart to prepare for exchanges with the other members of the jury. This result also confirms that the jury most prepared to analyze a radical innovation project is a jury composed of the market and innovation experts. This result qualitatively shows that the utilization of an evaluation chart could spark dialog and awareness, or an extension of awareness, in each expert outside of their own questions and concerns.

6. Conclusion

Our selection model dynamically and collectively measures evidence of value, concept, and innovation of a radical innovation project presented in the form of a business case to investors, members of an evaluation committee, and any other person having to analyze the project. This model

facilitates and accelerates the detection of "good ideas" of innovative products and/or services by innovation and market experts. This model is all the more effective because it accounts for the set of notions of innovation held by the actors of a complex market. It invites these players, in the context of a procedure, to cooperate and to facilitate the creation of a common language, using a common evaluation chart of the proofs of value, innovation, and concept of a radical innovation project. This evaluation chart is useful in creating a dialog among the experts with the goal of creating an articulation of the set of indisputable commonalities that they all share for a radical innovation project. This model could diminish the risk of investing funds in a project for which the idea is not mature enough to demonstrate the existence of a potential for success in a market. The experts questioned even suggested that this procedure could be still more effective with the addition of a prior day-long training session to allow them to test the model in a training environment before using it as part of the juries assessing real innovation projects. The evaluation chart is also a tool to diagnose the strengths of a project along with its gaps to be filled in (from the point of view of proofs of value, innovation, and concept). It could allow an entrepreneur to create a guide on composing a business case in order to convince investors or organizations to support him in the development of his radical innovation project. Finally, this evaluation chart could make it possible to start from this diagnosis and propose personalized coaching on solidifying lacking or insufficiently verified proofs of value, innovation, and concept in a radical innovation project. Lastly, our radical innovation project selection model readily adapts to the context of an innovation cluster, because it contributes to its raison d'être, namely: being a facilitator of meetings and an accelerator of innovation. The process also offers a complementary tool to the tools described in the Radical Innovation Design® methodology [Yannou et al. 2011].

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Benjamin Zimmer
PhD student
Ecole Centrale Paris, Laboratoire Génie Industriel
Grande Voie des Vignes, 92 295 Chatenay Malabry CEDEX, France
Telephone: +33 1 41 13 15 21
Telefax: +33 1 41 13 12 72
Email: benjamin.zimmer@ecp.fr