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From need to requirement: a methodological contribution

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Abstract— Decision taken during the Fuzzy Front End (FFE) have a high impact on the outcome of the innovation process. Therefore, product designers need methodologies and tools to manage innovation projects during these steps. A review of the literature was used to clarify the concepts of needs and requirements and how they relate to each other. The main contribution of this research is to define a methodology allowing the passage from need to requirement within an innovation process. A step-by-step methodology based on models is proposed starting with the description of users functioning modes, including the analysis of dependencies users face to achieve their own objectives and then allowing the elaboration of requirements lists. A case study is presented to illustrate this methodology.

Keywords— *Innovation, Need, Dependency, Resource problem, Requirement, Systemic model*

I. INTRODUCTION

Decisions taken during the Fuzzy Front End (FFE) defined as “the period between when an opportunity is first considered and when an idea is judged ready for development” have a high impact on the outcome of the innovation process [1], [2]. Benchmarking analysis and customer needs research are among the factors that influence the evolution of the product concept [3]. Thus, customers and ecosystem stakeholders’ needs analysis represents a major task complementary to others design activities including: technological survey, creativity and experts enquiry. As needs characterize individuals and groups of people, it is a human variable. Therefore, considering innovation processes the necessary description of needs concerns customers and all stakeholders belonging to the value chain of the future product: suppliers, public institutions and any intermediaries. Need analysis methodologies may help designers to collect and treat data relating to need. These data about the stakeholders then have to be translated into concepts describing the future product. The notion of requirement is mostly used to describe these first descriptive elements of the future during the FFE. Requirements represent “what the product has to do” [4] and must allow to specify the product. The sequence made up with the data about the stakeholders, including the need analysis and the requirements list elaboration, represents a critical activity in innovation. For this reason, it is important to understand the differences between needs and requirements and how they fit into the innovation process in order to help design decision-making in uncertain, information incompleteness and equivocality context [5].

In the literature, need analysis always appears upstream the definition of requirement. Adopting a systemic view of the

functioning mode of the stakeholder, the innovative product described through requirements has to become a new resource of the stakeholder and more precisely a resource stimulating the achievement of its goal [6]. Thus, bridging the outputs of the need analysis and the inputs of the requirement definition task appears as a key success factor in design activities. It consists in defining requirements that, if achieved, solved stakeholders’ problems of resources. The concepts of need and requirement constitute the background of the research. A literature review is conducted to update the main definitions. The aim is to elaborate a methodology to bring these two notions, contribute to the structuration of the design process and allow the treatment of need descriptive variable into requirement.

This paper is organized as follows. Section II presents a dedicated literature review on the “needs” and “requirements” concepts. Section III presents a methodology facilitating the transition from need to requirement, followed by a case study in Section IV. Conclusions, limitations and future perspectives for our work are presented in Section V.

II. THEORETICAL BACKGROUND

A. What is a need ?

In a context of innovation, an interrelation between the concepts of **resource** and **need** is established [7]: the lack of a particular resource is at the origin of the sensation of needs by an individual or a group. Then, an innovative product corresponding to one stakeholder needs has to solve one of the following three situations impacting the stakeholder [8]: (i) a resource is missing which implies that an additional resource must be proposed (ii) a resource is not adapted to the problem and must therefore be replaced by a new one (iii) a resource is adapted to the problem but

is of low quality and therefore an improved resource can be adopted and (iv) the actor uses many resources and therefore it is possible to concentrate them in one resource. Needs are problems limiting the functioning modes of a stakeholder. Considering the set of resources mobilized by a particular stakeholder, four operations allow the identification of needs to be satisfied by the future product [6]:

- **Addition:** the innovative product improves the functioning mode of the stakeholder by adding a supplementary resource within the set of used resources,
- **Substitution:** the innovative product improves the functioning mode of the stakeholder by replacing a present resource within the set of used resources,
- **Improvement:** the innovative product improves the functioning mode of the stakeholder by improving the quality of a present resource within the set of used resources,
- **Fusion:** the innovative product improves the functioning mode of the stakeholder by integrating several present resources within the set of used resources.

In the sciences of care, basic, physiological or psychological needs are linked either to an individual state allowing well-being if they are satisfied, or to an individual state inducing stress and pathologies if they are not satisfied [9]. Then, the concept of need relates more generally to the one of **dependency**. The stakeholder achieves its objectives and feels satisfaction if he is not limited by the quality and quantity of resources at his disposal. So, defining needs corresponds to the identification of limiting factors to the functioning mode of the stakeholders. In his model, [10] proposed five categories of needs through his famous pyramid: starting with the most basic physiological demands (food, water), upward through safety needs and belonging needs, rising with esteem needs and self-actualization. Even if the hierarchical aspect of this need typology is discussed [11], [12], a link is clearly established between need and dependency [10]. So, if one stakeholder is interviewed or observed, problems or customer pains may arise and have to be translated into dependencies toward the results the stakeholder wants to operate now or/and in the future [13], [14]. As an example, a fisherman may explain he gets problems when walking through bushes with his boot: tearing of its equipment. Its dependency relates to the material his boots are made with (nature and thickness). As a result, the major question in innovation is: "what is the customer depending on?"

There is a scaling effect about needs: individual and collective needs may be distinguished [15]. Collective needs correspond to the dependency of several people toward their resources. It is then possible to analyze the need of a market niche, a company, a family or any group of individuals sharing a common criterion (among others: localization, a task, a passion). The need of a group is not the sum of the individual need of the members of this group. Note that needs do not only relate to resources at disposal but also to the capacity of the studied stakeholder

to use these resources [11]. An innovative company is supposed to help a stakeholder to find and use its new product. Four dimensions of abilities to use a product may be suggested. First, physical capacities: strength, dexterity, mobility and duration. Second, financial capacity: the stakeholders get the financial means to get the resource. Thirdly, intellectual: corresponding to the necessary skills to use the resource. Fourthly, emotional dimension: the stakeholder feels well-being while deciding to obtain and use the resource.

There is also a temporal dimension associated to need. The impact of the new product may solve the resource problem immediately, in the short or long term. This affects the identification of need and further the validation process. Moreover, needs are changing in the society and as a result need analysis has to integrate a prospective dimension.

Behavior and needs are correlated to motivation [16]. More precisely, four categories are suggested [17]: the need (the force resulting from an internal dependency), the constraint (the force resulting from the response to a signal of the environment), the objective (the force resulting from the intention and wishes) and the pulse (uncontrolled sudden reaction). Then, need emerges when (i) a relative or the professional hierarchy give an obligation or when a contextual constraint emerges (external motivation), (ii) a sensation of guilty appears if the need is not satisfied (introduced motivation), (iii) a related goal is considered as essential (identified motivation) and (iv) a pleasure is resulting when the need is satisfied (personal motivation) [18].

The societal dimension of need has to be highlighted. Societal characteristics influence the subjective perception of well-being mainly through accessible information [19]. Then, need assessment methods may attest of serious limitation. It could be hypothesized that several data collection approaches are necessary to get a reliable need understanding. Moreover, an individual will express its need relating to an innovation taking into account his own envisaged benefice [20]. This judgment is influenced by the way the individual thinks he will be able to use and master the new product. As a consequence, people lacking self-confidence may express a negative or moderate opinion about a new concept within a first analysis. And need evaluation may underestimate the real interest level upon the innovation.

The ability of an individual or a group to express its own need is also questioning. Hence, four categories have to be distinguished [21]:

- **Tacit or implicit need:** people declare their interest toward a product or a service when facing it. But they are unable to detail their need previously,
- **Explicit need:** what people describe corresponds to their real need,
- **Normative need:** it results from laws, norms and other rules,
- **Comparative need:** it emerges when people compare themselves with other people.

Moreover [22] suggest and interdependency between categories as shown in figure one.

Explicit needs	Fulfilled	Unbalanced well-being Quest for objects without pleasure	High emotional well-being Quest for objectives related to positive effects on morale
	Unfulfilled	Reduced well-being No quest for objectives	Low well-being Lack of objectives that would allow explicit needs to be fulfilled.
		Unfulfilled	Fulfilled
		Implicit needs	

Fig. 1. Relation between explicit and tacit needs and satisfaction [22]

Considering this classification and complementary to [23], the following approaches may be proposed to collect data about stakeholders to identify:

- Explicit and comparative needs: Methods with direct contact with the stakeholders, including: questionnaires, session with eyes tracking, direct observation campaigns, workshops where stakeholders compare different offers, on-line co-working sessions,
- Tacit and comparative needs: Experimental methods where designers simulate the user's behaviors, including: prototyping and tests of products,
- Explicit and comparative needs: Data collection approaches based on internet data mining including: internet forum analysis and influencers observation,
- Tacit and normative needs: Experts enquiries including contacts with professionals in direct relation with the targeted stakeholders, experts enquiry,
- All categories of needs: Literature review including various sources: standards and marketing documents among others.

In conclusion, need is a complex concept having an individual and collective dimension. Its identification requires pluri-methodological protocols.

B. What is a requirement ?

Requirements are considered prerequisites for the design and development stages of a product. They are defined in the literature as “a statement that identifies a system, product or process characteristic or constraint, which is unambiguous, clear, unique, consistent, stand-alone (not grouped), and verifiable, and is deemed necessary for stakeholder acceptability” [24]. Two types may be distinguished: the stakeholders’ requirements and the system requirements. The first ones are based on an analysis and transformation of the needs of stakeholders into a set of requirements that express the expected interaction of the system with its operational environment [25]. Therefore, they are expressions of a documented need for what a particular product or service should be or do. It is the result of a need analysis and accurately represents the

needs of the stakeholders. The system requirements transform the vision of the stakeholders by creating a set of measurable variables that specify what characteristics, attributes and functional requirements the system is to possess in order to satisfy the stakeholder requirements [25]. Therefore, the specification of system requirements leads to the design of the new product.

According to [26], the stakeholders requirements specification serves as the basic document and starting point for the development of the system. It is a prior blueprint to any system development, which states the customer's needs and expectations in natural language and is necessary to the system. It indicates the functions, capabilities and constraints expected of the final system. It should capture the functional requirement and not the design and technical solution. What is expected is the description of the future effect of the product, but not the way to achieve it or the methodology. Requirements are formulated in natural language, it is a form of contract between a supplier and customers.

These previous definitions allow to identify all the requirements to be considered in the development of the system. Designers group them into functions that characterize the system. These functions relate mainly to the technological system that must orchestrate the social and industrial system. These requirements describe how the function of the system is to be realized without giving the solution for their implementation.

A distinction is generally made between functional requirements (what a system must do), specifying something that the delivered system must be able to do. Another type of requirement stipulates something about the system itself, and how it performs its functions. They are often called "non-functional requirements," "performance requirements," or "quality of service requirements. Three categories are distinguished in project management:

- Business requirements that describe the what in business terms. They describe what must be provided to produce value.
- Product requirements that describe the product or system at a high level. They meet the business requirements and are commonly formulated as the functionalities that the system must achieve. They are also called functional requirements or functional specifications.
- Process requirements that describe the “how”. They prescribe the processes that must be followed and the constraints to which one must conform for the realization of the system. In this case, we find for example safety, quality assurance or management requirements.

The definition of requirements is a multi-level process respecting the organic architecture of the product. Thus, for the design of the Airbus A380, Choreau and de Chazelles [33] distinguish them for each of the stakeholders (including the purchaser of the aircraft): the aircraft, subsystems or equipment, and components. For each level they distinguish the activities of: capture, analysis, validation and allocation. Capture and analyzing is considered at the elicitation step [23].

Well-formulated requirements must be:

- Necessary - They must address necessary elements, i.e., important elements of the system that other components of the system could not compensate for.
- Unambiguous - They should be susceptible to only one interpretation.
- Concise - They must be stated in language that is precise, brief and easy to read, and that also communicates the essence of what is required.
- Consistent - They must not contradict other established requirements, nor be contradicted by other requirements. In addition, it must, from one requirement statement to the next, use terms and language that mean the same thing.
- Complete - They must be stated entirely in one place and in a way that does not force the reader to look at additional text to find out what the requirement means.
- Accessible - They must be realistic in terms of what can be done with the money available, with the resources available, in the time available.
- Verifiable - They must be able to be determined by one of four possible methods: inspection, analysis, inspection, analysis, demonstration, or testing.

A requirement relates to the existing environment and captures both the consistencies and anomalies [27]. This description is shown using models. These models (described later) are tools to describe the functions performed, the data flow, the relations between pieces of information, the major events, the system's performance in time.

The philosophy of "observe before you analyze" involves establishing (i) the scope and plan for the requirements effort, (ii) the construction of the function, information and user-mode interface models according to the standard modeling procedure, (iii) the integration of the three models among themselves, (iv) the integration of the three models back into reference models and finally (v) the preliminary evaluation of the needs analysis results against the current system definition.

Prioritizing requirements remain a main challenge in the upper steps of project design and propose the use of multicriteria decision aided methods [28]. The correlation between well-being and the level of the requirement is questioning. Kano proposes a model based on product's position on a "Performance" Vs "Satisfaction" map [29]. On the horizontal axis of figure two, the physical sufficiency (technical performance level) of a certain product attribute is displayed. The vertical axis is an evaluation scale of the customer satisfaction toward this attribute. It defines product attributes into four major quality dimensions, namely, Must-be (M), One-dimensional (O), Attractive (A), and Indifferent (I) [30].

The "Must-be" requirements are associated with features that must be present in the product and will prevent dissatisfaction. The "One-dimensional" ones are explicitly requested by customers, and their full and proper fulfillment will lead to customer satisfaction, with

customer satisfaction being a linear function of how these requirements are fulfilled. The "Attractive" ones are not considered by customers during their use of the products or services. As such, failing to fulfill them will not lead to customer dissatisfaction. However, their presence will boost the level of customer satisfaction and excitement. At last, the "Indifferent" requirements: when customers are "indifferent" to the improvement of the performance of the product. They are attributes which are no more or rarely needed by users.

Finally, once the stakeholders' requirements are well-defined, the system requirements can be specified to describe the future product.

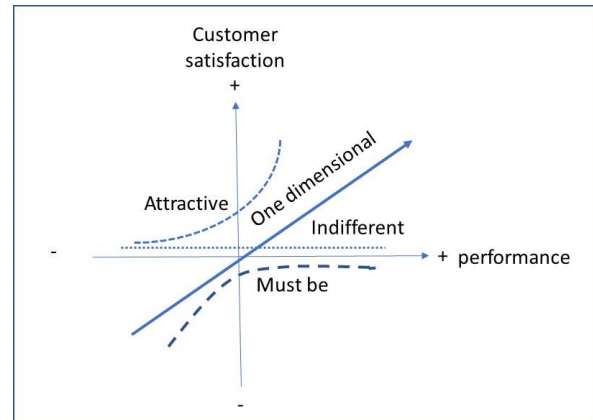


Fig. 2. The Kano Model [30]

III. CONTRIBUTION TO NEED ANALYSIS AND REQUIREMENT DEFINITION: PROPOSITION OF A METHODOLOGY

The objective is to be in line with the objectives of Systems Engineering which promotes, on the one hand, the role and relevance of different models at each stage of a design project, and on the other hand, the interest of processes to organize the activities of designers. It is a question of making design decisions while ensuring, then improving the quality and relevance of these models. The goal is to facilitate first the detection of errors, omissions or ambiguities in the modeling, then to look for justifications (proofs, results of evaluations, arguments) as to the respect of at least some types of requirements that the modeled system must meet. Finally, we try to ensure the traceability of these justifications. The unified System Development Methodology suggests a design cycle starting with the "understand the problem" stage integrating a need analysis and a requirement definition, before formulating solution. The aim of the research is to specify this passage from need analysis to requirements capture. The contribution relates to the definition of requirements based on needs, and thus, to propose a heuristic linking needs and requirements. A five steps methodology is proposed in figure three, each step being based on concepts of the literature.

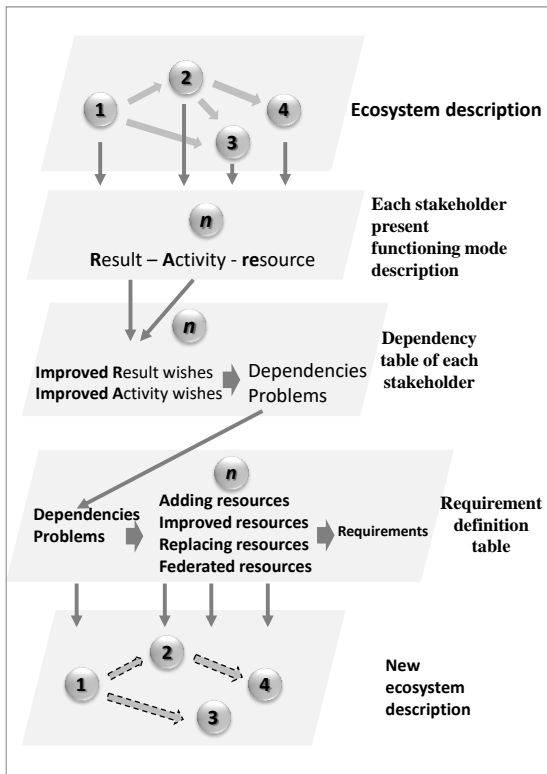


Fig 3. Five steps approach to link needs and requirements

A. Step one: Description of the studied ecosystem

As previously explained, individual or collective needs are impacted by the environment. As a result, understanding the ecosystem of the targeted stakeholders is essential. Then, the first phase of the need analysis consists in a systemic representation of the ecosystem involved in the life cycle of the future product. This includes censusing any individual or group playing a role in the production, the sale, the maintain, the used and the recycling or destruction of the considered product or service. This ecosystem is complex and integrates: users, prescribers, advisers, funders, producers and suppliers. To get a better understanding of this ecosystem the interrelations between these several “worlds” of stakeholders are described. The flows are material (e.g supply), digital (e.g CAD drawing), financial (e.g payment) and intellectual (e.g advice). A matrix is used to list all the interrelations where the transaction between two stakeholders is representing by “A gives to B”. This matrix modeling the ecosystem, consequently will help anticipating changes potentially induced by the new product on flows and on stakeholders (appearance or disappearance of actors). Note that some groups of stakeholders could finally be summed up considering personas [31]

This step requires contact with stakeholders, consulting documents like customers/suppliers' contracts.

B. Step two: Description of the functioning of the stakeholders involved

The functioning mode of each stakeholder or persona is then modeled. The specific periods when the stakeholder could be later confronted to the new product are considered. Considering the link between the concepts of

need and resource detailed in the above state of art, a systemic model called Results/Activities/Resources (RARE) flow sheet is used to describe the functioning mode of each stakeholder concerned with the innovation. It consists in describing the present activities (A) of the stakeholder and the outcomes/results (R) of these activities. These results are material (physical or digital production), immaterial (data and information) and affective (feeling induced by the transaction). Finally, the analysis focuses on the census of the resources (Re) mobilized nowadays by the stakeholder to produce the results and operate the activities.

This RARE model, presented in TABLE I, helps understanding the role of the stakeholder in the ecosystem and gives a representation of its link with the potential future product. The next task consists in establishing a list of possible modifications within the set of resources that can have a positive impact on the activities or the results of the activities carried out by the studied actor. The hypothesis is that an innovative product that does not represent a new resource for the customer has no chance of success. Thus, within this step, it is necessary to study whether the new product solves a resource problem (Re) of the customer and consequently improves his activities (A) (safety or ease) and/or the result (R) (quality, performance, personal satisfaction) in order to ensure that its development is successful. Focusing on resources, the concept of dependency is used as an equivalent of need.

Step two requires stakeholders, interviews and observation, but also, literature reviews and experts contacts.

TABLE I. RARE MODEL

Results (R)	Activities (A)	Resources (Re)
Material		
Immaterial		
Feeling		

C. Step three: Description of the stakeholder's objectives

The third step of the methodology consists in listing the objectives of each stakeholder. Objectives are more precisely linked with ambitions and hopes that are translated through the RARE model as:

- An improvement in the results (R) the stakeholders produce, this integrates [32]: better product performances, higher quantity product production and new supplementary product;
- Activities (A) to be simplified (safety, security, ergonomic among others) or assumed any more.

The variables limiting the capacity of the stakeholder to achieve his objectives are then listed. For each objective, these limitation factors relate to weaknesses of resources mobilized by the user and characterized the dependency of the stakeholder. Most of the dependency factors are correlated with problems the stakeholder is facing. These problems are directly formulated by the stakeholder or observed in Table II.

TABLE II. STUDY OF DEPENDENCIES

Stakeholder wishes	Dependency factors	Correlated problems experienced
New results (R) to be produced		
Improvement of the quality of the produced results (R)		
Higher quantity in the production of results (R)		
Activity simplification (A)		
Activity dis appearance (A)		

This requires meetings with the stakeholders but also the analysis of the major trends in the domain including digitalization, sustainability and safety.

D. Step four: Definition of the requirements

This step consists of identifying for each activity what needs to be achieved in order to reach the final objectives. For this, it is necessary to formulate stakeholder requirements, describing what the product must be able to do. To do this, the designers ask themselves the following questions:

- Which new resource must be added (addition operator) to limit or remove one or more dependency factors?
- Which resource should be improved in terms of quality (improvement operator) to limit or remove one or more dependency factors?
- Which resource must be replaced by another (replacement operator) to limit or remove one or more dependency factors?
- Which resources need to be federated (merge operator) to limit or remove one or more dependencies?

Once the stakeholder requirements are well defined, they must be translated into a system requirement, describing what the resource must do to satisfy the user (Table III).

TABLE III. DEFINITION OF THE REQUIREMENTS

Stakeholder wishes	Dependency factors	Correlated problems experienced	Requirements: Concepts of solutions impacting the dependency factors			
			Added resource	Improved resource	Substitute resources	Merged resource
New results (R) to be produced						
Improvement of the quality of the produced results (R)						
Higher quantity in the production of results (R)						
Activity simplification (A)						
Activity dis appearance (A)						

E. Step five: Description of the future ecosystem

This is a synthetic phase where the implementation of the requirements is anticipated. It consists in modeling the future flows between the stakeholders in the case of the fulfillment of the requirements. This helps the designers to have a prospective view of the future value chain of their innovative solution.

IV. CASE STUDY: IMPLEMENTATION OF THE METHODOLOGY FOR AN INNOVATIVE FLOATING GARDEN

The case studies aim at a better understanding of the relevance of the method. In a constructivist perspective the objective of the experimental part consists in observing if: the methodology is understandable to designers, used to take genuine decision, applicable to different situations, and, repeatable by some people. Among the different case studies, the project of floating garden is retained. It is an innovation for the considered company (that wants to stay anonymous) whose strategy is to add an own product to its historical subcontractor offer in the domain of plastic components.

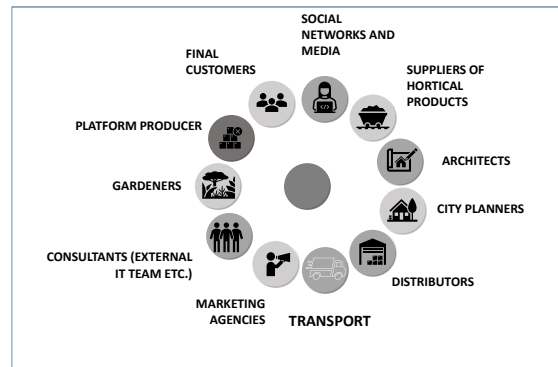


Fig 5. The ecosystem of an innovative floating garden

The ecosystem integrates customers and intermediaries, but also people influencing the market (Figure 5). One characteristic is the presence of advisors about the esthetic of the site where the dispositive is installed and also of living material suppliers (flowers, vegetables among others). The functioning mode of each stakeholder is achieved thanks the Rare model. Table IV gives the model for the people maintaining the plant production of the

floating garden. It shows that the distance between the garden and the bench as well as the constant move of the garden are important features when planting. Moreover, upstream the maintenance, humid context is a key factor when choosing the plants.

TABLE IV. RARE MODEL OF THE PERSON IN CHARGE OF MAINTAINING THE FLOATING GARDEN

RESULTS	ACTIVITIES	RESOURCES
- Garden close to the bench Tiredness	Identifies the localization of the garden	Energy, time
	Moves the garden to the bench	
Plants planted or sown Tiredness Threat of falling into the water	Puts growing medium	Seeds and plants adapted to humid contexts, tools
	Makes holes in the growing medium and/or rakes it	
	Plant and sow	
	Take water in the pool/river/lake to water the plants	
Garden in position Beautiful landscape	Push back the floating garden	Energy

Some activities are different from those of a traditional gardener like the way to achieve watering: in our case the environment is represented by a lake, a river or pond/pool considered as direct source of water. In this case no historical data about need analysis are at disposal and then a better understanding of the needs of the maintainer is necessary. Then, in connection with the Rare model, the dependencies are listed thanks interviews, discussion with experts (like people using barges or institution managing canals).

TABLE V. DEPENDENCY TABLE OF A PERSON MAINTAINING A FLOATING GARDEN

Stakeholder wishes	Dependency factors	Correlated problems
New results (R) to be produced: a secure garden	The floating garden stability is depending on the surface, the weight and the design of the garden	Instability, drop in the water, fears
New results (R) to be produced: no loss of tools	Position of the tool box	Tools falling into the water
New results (R) to be produced: an accessible floating system	Accessibility, moving system	The garden is far from the bench, it is necessary to go into the water to have access to the garden
Improvement of the quality of the produced results (R): esthetic of the environment (lake, pool...)	The type of plants at disposal	The plant to do not have a long live cycle because of the context, range of possible plant to narrow
Activity dis appearance (A): no more watering activity	Plants access to the nearby water	Plants drying

The dependency table filled by designers helps the definition of the exigence that are defined in terms of physical characteristics (weight, surface among others): note that for confidential reason these requirements are not detailed (some limitations are defined by designers for each variable. Some requirements relate to part to be added to

the platform (tool box for example). Some requirements have to be considered as options: this is the case of the motorization versus a permanent link between the platform and the bench.

Finally, company's designers elaborate the specification of the innovative platform. And when this paper is written, the launching of a subsidiary dedicated to this new product is discussed. Thus, the method is considered as efficient as it has been integrated in the decision process of the company. Four people have mobilized the approach with the supervision of authors and have the ability to use the approach on other projects.

V. CONCLUSION

This research is a contribution to the design step concerned by the treatment of data about the customers to define requirements.

One main element of the proposed approach is the modeling of the functioning modes of stakeholders with the RARE model and the special interest about resources. Moreover, the connection between the wishes of the stakeholders and the results (R) and activities (A) helps to formalize the ambition of the stakeholders.

The concept dependency is also basic in this proposition as it allows the definition the limitation the stakeholders is facing. As problems are easier to observe, the relation between dependencies and problems is important.

A methodology is proposed to help designers to define the requirements meaning concepts of solution that limits or delete the limitation factor (dependencies).

On a constructivist point of view, the methodology is efficient as it facilitates decision-making, designers are able to manage it on other projects (in some companies where we had a long-term partnership), it is applicable on a wide range of projects (product, process and service design).

This approach and the models have been experimented but some aspects remain to be studied. Among others, the Rare model attests of some limitation when considering psychological dimension of the stakeholder behavior. Some sensations like fear, absence of trust or, on the opposite, passion are highly important when describing the effect of a product on a stakeholder. The proposed approach is not totally adapted to integrate this subjective dimension of the perception of the user. Moreover, some experimentations in the domain of formulated products like food and cosmetics attest of some limitations when elaborating the RARE models. More precisely, the vocabulary used by customers is often difficult to treat. Customers ask for "cloudy" cream, "light" products, "secure" food among others without being able to give more details. Then, the modeling of needs and requirements is difficult. One research perspective is then to elaborate thesaurus to put at designers' disposal a methodology to get a better understanding of stakeholders wishes.

TABLE VI. DEFINITION OF THE REQUIREMENTS FOR HELPING A PERSON IN CHARGE OF MAINTAINING A FLOATING GARDEN

Stakeholder wishes	Dependency factors	Correlated problems experienced	Requirements: Concepts of solutions impacting the dependency factors			
			Added resource	Improved resource	Replacing resource	Federated resources
New results (R) to be produced: a secure garden	The floating garden stability is depending on the surface, the weight and the design of the garden	Instability, drop in the water, fears	Parts allowing the handling of the floating garden	Instructions to place the garden on the water surface	The material of the parts allowing floating has to be strong and sustainable	Compromise has to be found between the floating characteristics and the weight of the platform
New results (R) to be produced: no loose of tools	Position of the tool box	Tools falling into the water	A system to place several tools or a tool box on the platform	-	-	-
New results (R) to be produced: an accessible floating system	Accessibility, moving system	The garden is far from the bench, it is necessary to go into the water to have access to the garden	A motorization of the platform	A system that limits the move of the platform	-	A permanent link between the bench and the platform
Improvement of the quality of the produced results (R): esthetic of the environment (lake, pool...)	The type of plants at disposal	The plant to do not have a long live cycle because of the context, range of possible plant to narrow	-	Selected plants adapted to the context (humidity and climate)	-	-
Activity disappearance (A): no more watering activity	Plants access to the nearby water	Plants drying	-	A system allowing the water to access the roots of the plants without added energy	-	-

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