REfIS: A Stage-based Methodology for Eliciting Requirements

Felipe S. Ferraz[1,2], Leopoldo P. Ferreira[1], Rodrigo E. Assad[1,2], Renato A. G. P. França[1,2], Silvio Meira[1]
Informatics Center
Federal University of Pernambuco
Recife, Brazil
[1]{lpf,fsf3,rea,srlm@cin.ufpe.br}
[2]{fsf,rea,ragpf@cesar.org.br}

***Abstract*— Eliciting requirements is one of the most important phases in software development, which can lead the project to success or to failure. Particularly, when it comes to security requirements, the main responsibles for specifying software system have a lack of knowledge at security policies and the mechanisms for achieving them. This article proposes and presents a stage-based methodology called *REfIS* that aims to guide requirements engineers through the elicitation requirement process of software system. The methodology consists of three phases: (1) dispersion of knowledge about a certain universe of study through Casual Layered Analysis (CLA), (2) creation of a future scenario using Futures Wheel and (3) extraction of requirements from the analysis of the generated scenario. Finally, this methodology will be applied and validated at the initial phase of the development of a real P2P backup System in order to extract requirements.**

Keywords-eliciting requirements; methodology; innovation systems.

I. INTRODUCTION

The widely accepted concept of the innovation refers to the flow of technology and information among people, enterprises and institutions as a key to an innovative process or product. It contains and gives different and new interaction between the actors involved in the process and the process itself. It brings that actor across that new experience based on his previously knowledge.

When dealing with requirements, and users needs and expectations we may be facing a infinite universe of possibilities available for the specification of those kind of system we are also facing the infinite of the unknown, sure, we are presented to new ways, process and products and with that the task of define requirements meets challenges towards its time. This short paper, is a brief introduction to a new Stage-based methodology, called REfIS, that intends to present the definitions to systems that are not thinkable working on theirs definitions using techniques used among brain storm meetings. The methodology and the paper will introduce the use of CLA and Future Wheels combined as a approach to better understand and define innovational system requirements.

II. BACKGROUND

The main objective of this methodology is to combine CLA [1] and Future Wheels [3] techniques to propose a new approach to requirement analyses. To that, this section will shortly introduce those techniques focusing on present them as the first and second stages of REfIS.

A. Causal Layered Analysis (CLA)

Causal Layered Analysis [1] can be regarded as a sophisticated technique to organize thoughts and views about the future. Although ones affirms that this is only a way to predict the future, Inayatullah holds the idea that it can create transformative spaces for the creation of alternative futures. Particularly, this technique is less to do with forecasting methods and more with understand the present and past to build alternative future scenarios.

This technique is composed of four layers [2]: Litany, Social causes, Worldview and Myth/Metaphors. However, each one of these layers has different proposes and focus varying from different perspective of knowing. The main idea is to conduct a deep research by moving up and down these layers. Figure 1 depicts the layers of the Causal Layered Analysis.

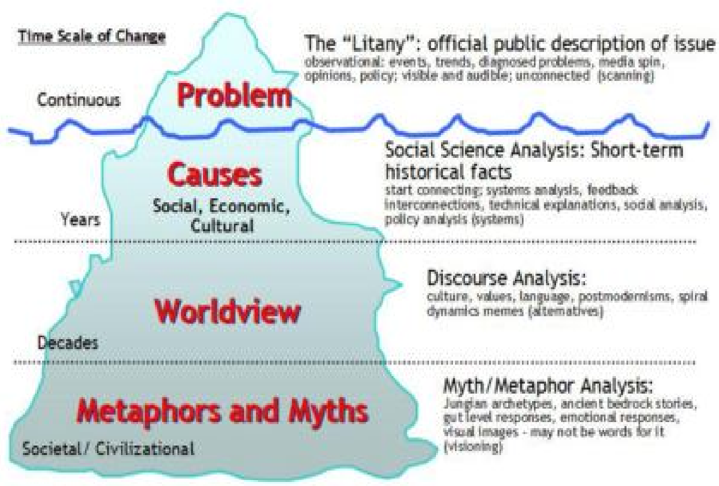

Figure 1. Layers of Causal Layred Analysis [1].

The first layer of CLA is called Litany. The participants of the meeting discuss, at this point, the public descriptions of the subject that is being analyzed. However, the view of the reality presented here are rarely questioned or used to make any suppositions about a near future.

The second layer, called Causes, is responsible for analyze the subject through the definitions found on the social sciences. At this layer, systemic events including

 ISBN: 978-1-61208-165-6

socials, technologics, economics, environmentals, politics and historicals are analyzed and its interpretations should be relied on quantitative data. Finally, the information gathered at the first layer are now questioned and explained.

The third layer is known as the Worldview. At this point of the analysis, all daily world view of the subject or event being studied should be discussed. Social-cultural factors of the population involved in the study are essentially required due to the strong impact caused by the context on the subject that is being analyzed.

Last but not least, the fourth layer, called Myth and Metaphor, is responsible for including in the discussion the myths, legends and metaphors related to the subject or event that is being analyzed owing to its influence on the beliefs of the participants as well as the society.

After all layers are analyzed and discussed, it is usually common to build a fifth layer called Future Choices where one makes statements about the events whose outcomes have not yet been observed. This forecasting process is depicted at figure 2 below.

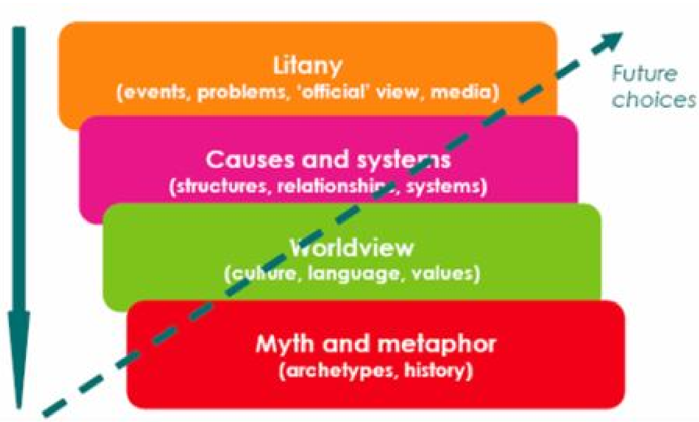

Figure 2. Bulding future scenarios through CLA [1].

B. *Futures Wheel*

Futures Wheel [3] was developed in 1971 by Jerome C. Glenn as a cross-impact analysis technique mainly used for predict impacts of future events, trends, ideas or values on a given context through a structured brainstorming process. Consequently, stakeholders are able to build relationships between events besides elicit and mitigate problems that might occur in a near future. In Gleen's own words, the "*Future wheels moves the mind from linear, hierarchical, and simplistic thinking to more network-oriented, organic and complex thinking*".

When a group (usually groups of 8 to 12 individuals) decides to brainstorm about a specific subject, it is written on piece of paper or a white-board, circled and placed in an oval at the centre by the leader of the brainstorming session or a facilitator's guiding. After that, it is requested to the other members to say whatever comes to their mind about the item that is being shown besides raising relevant questions to the discussion. As statements are offered by the team, the leader draws a wheel-like chart around the first item radially. At the end, the leader invites the participants to argue about the likely consequences of the new items that have just been drawn. Additionally, one can draw interconnecting lines between the primary and secondary impacts of a trend in order to establish relationship between them.

Usually, this process tends to go very quickly with the participants listing consequences with little or no evaluation. Alternatively, the wheel can be also edited in order to make it more realistic. In this approach, every statement discussed by the group has to be approved by all in order to be included in the wheel. The brainstorm session thereby tends to take more time due to the acceptation of prior criticism.

As a result of the session, the team should have developed a mind-mapping diagram that will work as a heuristic device for thinking about the future. To put it simply, the outcome of the process aims to nurture a future-conscious perspective. The final design seems like a hub of wheel with spokes radiating from it. As en example, figure 3 depicts the forecasting of the future of a videocassette recorder (VCR) device using Future Wheels technique.

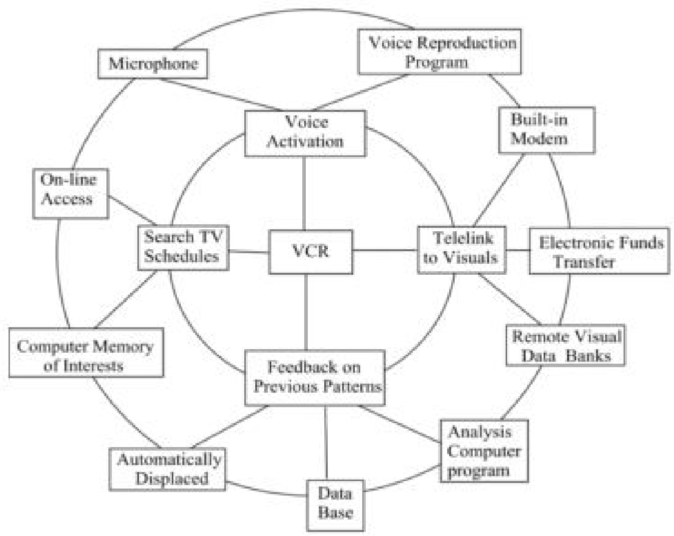

Figure 3. Example of a Future Wheel exploring the future of the VCR tehcnology [3].

A second version of Future Wheel was also proposed by Glenn in order to consider a wider range of consequences. For example, electric engineers would naturally tend to identify technologies improvements on our VCR example and put less effort on economics or environmental consequences. Consequently, the wheel is originally divided into pre-determined sections or domains to force the team to think about the trend as broad as possible.

III. METHODOLOGY

REfIS relies on *Requirement Eliciting for Innovation Systems*. Our goal is to guide stakeholders at early stages of a software development process, specially the requirement eliciting process [4] [5]. We understand that, when it comes to Innovation Systems that claims to be built on new business models, its requirements are not trivially defined and therefore require a methodology that helps the development team to think, discuss, and analyze everything the systems should perform [6].

Trustworthy, the methodology proposed by this paper is divided into three stages; however, the first stage can be omitted if the subject to be discussed is widely known by the stakeholders.

The first stage is called the *Dispersio*n. At this initial phase, the development team is invited to open a free discussion about the main subject of the software that will be soon developed. As an example, if the software concerns about a Video Conference system for facilitate company's internal meetings, the group may choose as the central event of the discussion, actual technologies for video-conferences systems. Once the subject is chosen, a second session should be started to analyze the consequences of the implementation of this idea using Causal Layered Analysis (see section 2a). The expected outcome of this analysis is the filling of a table that contains the variables identified by each layer on CLA.

The second stage is called the *Modeling*. After the subject is widely discussed by the group, a second session is opened for modeling a scenario that describes the consequences and impacts on the software development process from the perspective of the trend analyzed on the previous stage. For modeling the scenario, we suggest the use of the second version of Future Wheels technique. Consequently, the wheel must be sectioned into domains that may have some influences on the topic discussed. As an example, we divided a generic wheel on different contexts of impacts (educational, economical, political, etc.), as depicted on figure 4.

Finally, the group will answer the following questions for each circle in each domain:

(a) What would happen if this circle is omitted from the implementation?

(b) What requirement(s) should be implemented to prevent this from occurring?

In a future scenario, the circles can be joined into one single circle in order to define a broader requirement that cover more than one consequence.

At the end of the process, the group is expected to create a wide variety of requirements grouped by sections of interests. These requirements now can be used to compose a structured Requirement Documentation.

.

IV. CONCLUSIONS AND FUTURE DIRECTIONS

At this moment of our study, we are preparing a Quasi-Experiment [7] to analyze the impact on time, quality and stakeholder's feedback of the process. This experiment will take place at the Recife Advanced Center of Research and Study (CESAR) and will be applied on a new P2P Backup [8] [9] system that is being developed by local researchers [11][12] [13]. As it is a new area of study and there is a lack of solutions using this kind of technology, stakeholders are quite unsure about what requirements should be elicited for this particular system [10]. Our main goal is to guide their requirement tasks by combining these two powerful techniques described in the past sections of this article.

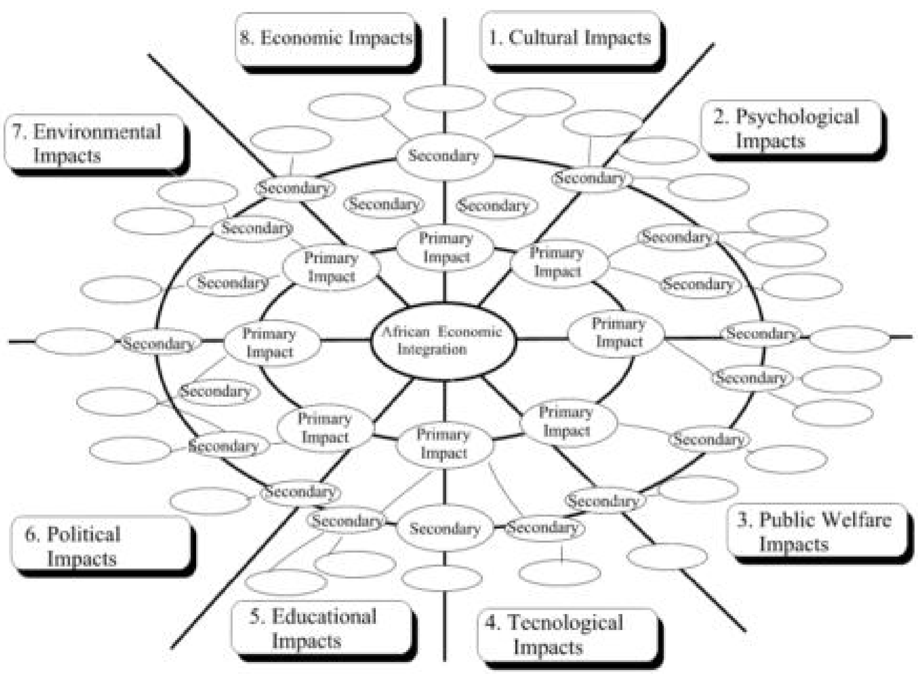

Figure 4. Example of a Future Wheel divided into sections [3]

 ISBN: 978-1-61208-165-6

In order to define specific goals for this experiment, we have established the following questions:

Q1 : What are the quantitative and qualitative benefits of using *Refis* from the point of the view of the stakeholders in the context of eliciting requirements in contrast of past methods used by the team?
Q2 : What strengths and weakness were identified during the technique appliance?
Q3 : What other techniques can be combined with *Refis*?

After the experiment evaluations, our academic and professional commitment is to present this work into further details to the science computer community as a new and promising methodology for eliciting requirements.

V ACKNOWLEDGMENTS

This work was partially supported by the National Institute of Science and Technology for Software Engineering (INES[1]), funded by CNPq and FACEPE, grants 573964/2008-4 and APQ-1037-1.03/08.

REFERENCES

[1] S. Inayatullah, “The causal layered analysis (CLA) Reader,” 2004.
[2] S.I. This and S. Inayatullah, “Causal Layered Analysis - Deepening the future,” 2005, pp. 1-22.
[3] J.C. Glenn, “The futures wheel,” Washington, DC: United Nations University.(Part of Glenn 1994a), 1994.
[4] B. Nuseibeh and S. Easterbrook, “Requirements engineering: a roadmap,” Proceedings of the Conference on the Future of Software Engineering, ACM New York, NY, USA, 2000, pp. 35–46.
[5] G. Sindre and A.L. Opdahl, “Eliciting security requirements with misuse cases,” Requirements Engineering, vol. 10, 2004, pp. 34-44.
[6] M. Hadavi, V. Hamishagi, and H. Sangchi, “Security Requirements Engineering; State of the Art and Research Challenges,” Proceedings of the International MultiConference of Engineers and Computer Scientists, vol. 1, 2008, pp. 19-21.
[7] G.E.L. Cohen and G. Susan G. Jr, “Effectiveness of Self-Managing Teams : A Quasi-Experiment,” Human Relations, Vol.47, No 1, 1994, pp. 13-43.
[8] C. Miller, P. Butler, A. Shah, and A.R. Butt, “PeerStripe: a p2p-based large-file storage for desktop grids,” Proceedings of the 16th international symposium on High performance distributed computing, ACM, 2007, p. 222.
[9] R. Butt, T. a Johnson, and Y.C. Hu, “Kosha: A Peer-to-Peer Enhancement for the Network File System,” Proceedings of the ACM/IEEE SC2004 Conference, 2004, pp. 51-51.
[10] C. Batten, K. Barr, A. Saraf, and S. Trepetin, “pStore: A secure peer-to-peer backup system,” Unpublished report, MIT Laboratory for Computer Science, 2001, pp. 130-139.
[11] M. Pinheiro, R. Assad, F. Ferraz, L. Ferreira, and S. Meira . An Availability Algorithm for Backup Systems Using Secure P2P Platform. In: International Conference of Software Engineering Advances, 2010, Nice, France. ICSEA, 2010, pp. 471-478.
[12] T. Katter, R. Assad, F. Ferraz, L. Ferreira, and S. Meira. Security Quality Assurance on Web-Based Application through Security Requirements Tests: Elaboration, Execution and Automation. In: International Conference of Software Engineering Advances, 2010, Nice, France. ICSEA, 2010, pp. 272-277.
[13] F. Ferraz, R. Assad, and S. Meira . A Relating Security Requirements and Design Patterns: Working with Design Pattern to reduce Security Requirements implementation impacts. In: International Conference on Software Engineering Advances, 2009, Porto, Portugal. ICSEA, 2009, pp. 9-14.

[1]INES – http://www.ines.org.br

 ISBN: 978-1-61208-165-6