AN INTEGRATION OF DECISION AIDING TOOLS TO SUPPORT PROBLEM FORMULATION IN INNOVATION PROCESSES

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Abstract

Acquiring and organizing knowledge and information elements are essential activities in the innovation processes, to understand complexity and uncertainty elements and therefore to control them. Not only technological, but also organizational complexities are present, together with uncertainties on the market that has to accept the innovation.

An analysis of these elements was developed in relation to the SMAT project, an industrial project which aims to design Unmanned Aerial Systems (UAS), which have to be equipped with sensors for specific data acquisition uses and data storage and communication systems, in order to work as an integrated monitoring system for a civil use. In SMAT-F1, the first phase of the project, we tried to identify the potential users of the monitoring system and the characteristics of their needs, and to analyze the points of view of the private and the public actors who should be involved in the innovation process.

In the last part of the industrial project, an integration of some "soft and hard" OR tools was proposed in order to formally deal with the unstructured knowledge elements that were acquired in the previous phase. Some soft OR methods, called problem structuring methods (PSM), were developed in these years "to record what people say or claim and to play this back to them inside a formal structure" (Franco and Montibeller, 2011).

These methods aim to provide a shared language to talk about complexities and uncertainties elements in a structured way and to synthesize all the knowledge elements that are significant in an innovative process (Norese, 2011). Actor network analysis and cognitive mapping can be used, in the PSM field, to code, synthesize and communicate the unstructured elements (positive or negative past experiences, worries, aspiration levels, difficulties, suggestions, …) that came from the possible end users of the monitoring system, but also to structure the decision context where individual/organizational actors could play a role (or multiple roles) in the future.

Cognitive maps and actor networks can be integrated with more classical OR methods, in order to formulate the problem situation for the next phase of the project. We are using mathematical programming and MCDA models in order to structure technological, organizational and economic constraints that limit the generation of design alternatives in relation to specific objectives, and to formally develop criteria (starting from the end users' vision on the acceptability of each innovation) that should be used in the next phase to orient analysis, decision and action.

Design alternatives and criteria are used in this last part of SMAT-F1 to formulate local problems and integrate them in a whole vision. The problems are formulated by the development of models and the application of methods that elaborate alternatives and compare them, in relation to specific land monitoring activities, or possible UAS missions, or scenarios of monitoring organization. Then a collective result analysis can be used to discuss the problem with some industrial partners, validate its definition and improve or reformulate it.

Each analysis of the models and the results of these "simulated" applications of the methods becomes a step of the organizational learning cycle, that is a base for the innovation processes.

In the presentation, the role of soft and hard decision aiding tools in this learning cycle and some problem formulation cycles will be described and analysed in relation to the potentialities of this integrated approach.

References

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