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ESTEEM: Managing societal acceptance in new energy projects A toolbox method for project managers ☆

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ABSTRACT

There is now a large literature dealing with the policy question of public participation in technical choice and technology assessment (TA). Files such as the mad cow crisis, genetically modified food, and the emerging nanotechnologies have been edified into a public problem, and have given place to a number of experiments and reviews about participatory arrangements. Much less attention has been devoted so far to the application of the TA framework to more local and limited projects–not yet and maybe never reaching the public problem status–and the management of their societal dimensions. Among them, new energy technology represents a very interesting field for investigation: many of the new energy enjoy a global positive public image whereas the local implementation of their implantation often raises societal questions and oppositions. This paper describes an original experiment conducted in the field of new energy technologies during which a participatory technology assessment inspired approach was applied to a number of individual and local projects. A framework methodology called ESTEEM was developed to facilitate such participatory process to take place, and it was tested and evaluated in 5 projects located in 5 different countries over Europe. A detailed discussion of the ESTEEM method and its application to one case study, a Carbon Sequestration project in The Netherlands, is provided. We show that a major question in the application in such participatory framework is to establish a reflective practice of project management based on situated and constructive interactions between project promoters and project stakeholders.

1. Introduction

Preventing and limiting effects of human activity on climate change has increasingly received attention from policy makers, NGO's, industry and citizens. Renewable and low-carbon energy technologies are considered as a major alternative route towards sustainability and–consequently–there are major political and industrial efforts to increase their share in the global energy consumption. With an average European market share of 6.38% in 2005 and global market share of 18% in 2006 (including traditional biomass and large hydropower), renewable technologies like wind turbines, bio-energy technologies and solar systems seem at the verge of breakthrough [1,2]. Current European targets are set to increase the share of renewable energies even further to 20% in 2020 [3]. Moreover, in its recent Energy Efficiency Action Plan the European Commission targeted a 20% energy reduction through energy efficiency improvements by 2020 [4]. Also clean coal and in particular carbon capture and sequestration (CCS) have gained attention as an efficient way to mitigate carbon dioxide emissions [5]. These targets and policy plans and their translation into member states' specific regulations and promotional activities have stimulated a wide variety of so-called "new energy" projects throughout the European continent.

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This overall picture seems very promising, but when considering the local implementation of projects in further details a quite different world turns up. At a local level, new projects face severe backlash due to a lack of societal acceptance, from citizens, neighbors or consumers, but also from other stakeholders like NGOs or national political and policy actors who intervene in project implementation. A recent meta-analysis of 27 new energy projects in Europe has shown that many projects are witnessing societal acceptance problems, ranging from a simple lack of interest to cooperate to explicit acts of severe and emotional resistance [6]. At a global level this local resistance often gave rise to major political and societal debates on the desirability of many new energy technologies. Wind energy is set aside by opponents as a landscape destroying, bird killing, expensive and obsolete technology [7]. More recently bio-energy has become heavily debated because of its potential to destroy ancient forests, its competition with food production and in some cases for its limited potential for carbon dioxide emission reductions. Carbon capture and sequestration is still in an early phase of development, but opponents and advocates are already debating whether or not it is a desirable solution at all. In sum, while policy makers and renewable industries are planning great futures, current reality is that many new energy technologies are facing major (explicit and implicit) acts of resistance.

Acts of resistance are not easy to anticipate nor are they easy to manage. Resistance often comes as a surprise to project managers because issues like societal acceptance can easily stay under the radar of traditional project management tools [8]. When a lack of societal acceptance does become an issue, the manager's defensive reflex is way too often to do it away as irrational, morally bad or at best understandable but futile [9]. This way of managing technological development and implementation has been criticized within the field of Science and Technology Studies [10,11] and in particular (Constructive, Interactive and Participatory) Technology Assessment [12–17]. These scholars have convincingly argued to open up technological development and allow feedback from society into the design process as early as possible. The underlying idea is that allowing feedback enables technology actors (science, industry) to learn about societal wishes and interests as early as possible, when there is still room for design adaptations, while societal actors (policy, users, NGO community) can learn about unknown needs or required regulatory, infrastructural or other systemic changes. Constructive Technology Assessment emerged in the 1980s, but its intellectual legacy is still present in more recently developed management tools.[1] Participatory Technology Assessment (PTA) recently provided further stimulating reflections about citizen participation to public policy debates [18,19]. Starting from the observation of a growing inefficiency and illegitimacy of experts' monopoly on technological choices, interesting investigations were pursued about methodologies of participating from enlarged assemblies of actors: representativeness of participants, modes of interaction, spaces opened for exchanging views [20].

These stimulating approaches have however been confined so far to national policy making debates and problems. One of the limits of such an overlooking approach is that it leaves aside a number of questions and singularities that make sense only at the scale of individual projects and only when project plans are confronted to actual implantation. Questions such as the timing of the project, the geography of its implantation, the local history of the site, the unique sociology of its people and their relationships are convocated by the local implementation of the project and make it the most complex to devise a unique standardized process of project management. All this makes it hard for central policy makers to devise workable rules and generalities about the technology and its diffusion: as the saying goes, the problem with generalities is that they do not apply to particular cases. This paradox makes it necessary that the project managers in addition to their acquired experience and standardized management tools pay attention and adapt their projects to a number of local singularities if they are to be successful. This paper describes an attempt to devise a fine tune method that would help project managers consider and adapt their plans to local singularities. Can we devise a method general enough to allow project managers to deal with relevant local singularities necessary for their success?

The research builds in particular on two previous investigations that have started exploring this ambitious programme: the Protee and the Socrobust experience [21–23]. They established a number of insightful lessons: a) what matters in the management of projects is not so much the local situation itself but the process through which projects managers learn about it and adapt their plans and design to it; and b) involving an external evaluator (PROTEE) or consultant (SOCROBUST) to help project managers think reflectively about that learning is an efficient arrangement. This paper describes a third investigation, made through an EU funded project called Create Acceptance, building on these two previous frameworks and proposing to explore an additional dimension based on a Participatory Technology Assessment approach.[2] In this case, a participatory dimension was added: to sustain the learning process, the consultant was indeed an evaluator (PROTEE) and a consultant (SOCROBUST), but equally a mediator (Create Acceptance) who helps to involve additional local actors in the implementation process. Additionally, this research builds upon insights from Strategic Niche Management and Transition Management that contribute a great deal of project success to articulating expectations and visions [24–27].

The aim of the project, in which ten partner organizations cooperated, was to develop a practical toolbox for project managers to deal with societal acceptance issues as early as possible in the development of a new project.[3] "As early as possible" refers to projects that to some extent have been planned and developed, but are not yet fully implemented. This is a practical pre-condition. Experiences in applying ESTEEM has shown that too early application complicates the process (there is not enough information available for a thorough participatory and vision building process), while too late application leaves little room for adjusting the

[1] Examples are Protee [21], Socrobust [34], Strategic Niche Management [24,25] and Transition Management [26,27]. Although there are many subtle differences between these approaches, they share the common idea of creating early linkages between technology developers and innovators on the one hand and societal actors on the other as a way to improve technological decision making processes and anticipating future problems and opportunities for implementing innovations.

[2] For more information see: http://www.createacceptance.net.

[3] The following partners participated: ECN (The Netherlands), CERIS/CNR (Italy), Ecoinstitute (Spain), IAE (France), INE (Iceland), IEO (Poland), MAKK (Hungary), NCRC (Finland), SURF (UK), ERC (South Africa). See also http://www.createacceptance.net/project-partners/.

project to societal input. Practically this means that a project has entered the design phase, when there is still room for adjustment of the initial plans without major loss of investments already done. Societal acceptance was broadly defined as existing when: 1) there is support for the technology among the expert community and national and local policy makers; 2) the general public has an informed and largely positive view of the technology; 3) concrete applications do not meet significant obstacles from local policy-makers, residents, the NGO community or other representatives of social interests; and 4) when the opportunity arises, ordinary people are willing and prepared to adopt the applications in their own contexts and to support them with positive actions. Practically speaking this meant that not only the general public would be a target group, but any relevant actor that could potentially oppose a new energy project.

The project has resulted in a new six-step Participatory Technology Assessment methodology for enriching established project management practice. A draft version has been tested and evaluated in five ongoing projects in Europe.[4] The project manager and selected stakeholders were elicited through a variety of tools to reflect on the project's past and context and envision the project's future and derive lines of action. The resulting method was called ESTEEM: Engage STakeholdEr through a systEmatic toolbox to Manage new energy projects. In this article we aim to present the results from CreateAcceptance by discussing the methodological approach to the development of ESTEEM (Section 2), the general characteristics and workflow of ESTEEM (Section 3) and provide the example of a zero-emission power plant in the Netherlands in which ESTEEM was tested and evaluated (Section 4). We end with discussions and conclusions to reflect upon our findings and discuss topics for further research (Section 5).[5]

2. Methodological approach to ESTEEM development

ESTEEM was developed in a 2 year research project in which different sources of data and working methods were used. We will not discuss the full methodological approach, but present a summary and refer to more detailed descriptions for different parts of the project. The project started with a review of Socrobust–an existing tool for managing breakthrough innovations–for its usability for managing societal acceptance of new energy projects. Some of the partners had been involved in the development of Socrobust, while others had experience with applying Socrobust in R&D projects, or brought general knowledge on innovation and stakeholder participation processes to the discussion. Sharing practical experience and theoretical knowledge among the project partners was the main working method. This first part of gathering information resulted in a list of potential gaps when using Socrobust for managing societal acceptance in new energy projects. For example, a major gap identified was that Socrobust instruments are not applicable in a multi-stakeholder setting, because they are used in a number of dialogues between consultant and project manager. Another gap that was identified is that Socrobust was developed for R&D projects, and not for implementation projects [28].

After the theoretical reflection, the project partners collected data on and analyzed 27 recent new energy projects in different European regions as well as in South Africa. The data set included a wide variety of technologies and both successful and unsuccessful projects. Societal acceptance was analyzed as a process of vision articulation by the project manager and subsequent (successful or unsuccessful) negotiation of stakeholder expectations. This analysis provided five managerial challenges for "good" project management including the challenge of introducing appropriate projects in appropriate contexts, the challenge to identify critical issues and stakeholders for evolving technologies, and the challenge of finding the right communication challenges for different actors [6,29].

The theoretical and practical reflections on Socrobust and the collection and analysis of recent experiences with managing societal acceptance provided the basis for a third phase of ESTEEM development. This phase, in which a draft version of ESTEEM was developed, had very much the character of a continuous brainstorm session. In several project meetings the partners discussed and thought through a draft version of ESTEEM. Working groups discussed face-to-face and through email and phone the design of parts of the process and outcomes were reported back at plenary meetings. Eventually the lively discussions resulted into a draft six-step process for managing societal acceptance issues in new energy projects [30].

The last part of ESTEEM development consisted of testing and evaluating the draft approach in five ongoing projects in various European countries: a bio-energy project in Jühnde (Germany), a wind park in Vep (Hungary), the SmartH hydrogen project in Reykjavik (Iceland), the Archimedes solar energy project in Priolo Gargallo (Italy) and a Zero Emission Power Plant (ZEPP) project in Drachten (The Netherlands). Application of the six step approach in these projects produced a rich set of experiences useful for the finalization of the ESTEEM tool [31].

3. ESTEEM: a six-step approach for managing societal acceptance in new energy projects

ESTEEM is designed as a process methodology consisting of six subsequent steps. Fig. 1 presents an overall view of the process. The goals of ESTEEM is to a) organize the start or improvement of a communication process between project manager and relevant stakeholders such as NGO's, policy actors and the local citizen community; and b) to develop several action plans for future action that the project manager can undertake to improve societal acceptance of the project. The process is facilitated by a "consultant", whose task is to organize the reflective practice of the project manager: reflection in action and on action through a variety of situated interactions and tools shaped in the ESTEEM method [32]. As we have noticed, the role of consultancy in Create Acceptance combines: a) this of evaluator, which implies some empathic skills to understand and enhance the coherent

[4] The projects included were a bio-energy project in Germany, a wind park in Hungary, a hydrogen project in Iceland, a solar energy project in Italy and a carbon capture and sequestration project in The Netherlands.

[5] For a review of experiences with the methodology and lessons learned see also Raven et al. [29].

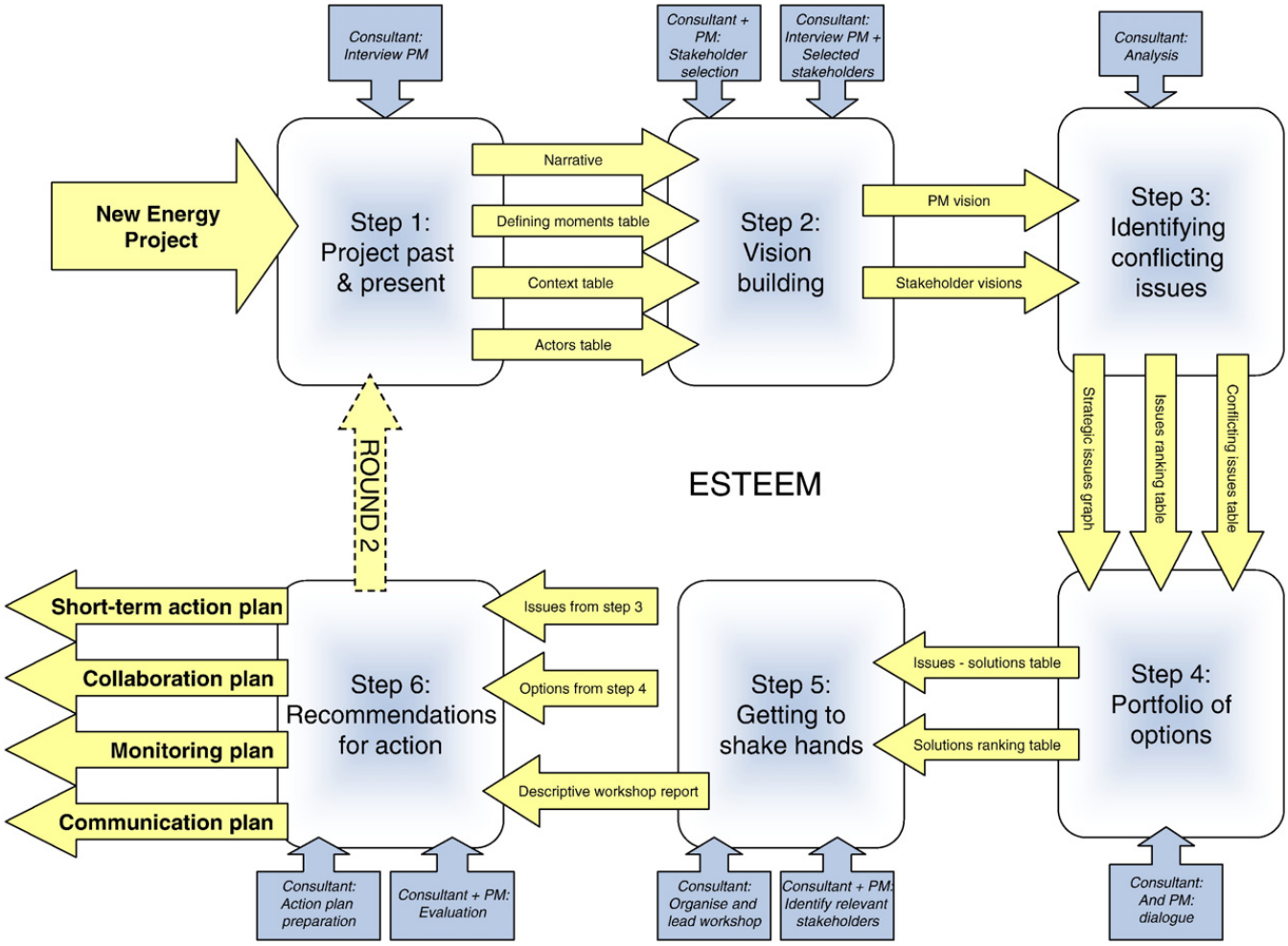

Fig. 1. ESTEEM and the six steps to develop action plans for societal acceptance. PM stands for 'project manager'.

formulation of the project manager vision b) this of a consultant, with an ability to help the project manager take some distance from his/her project, put some key assumptions about the future to the test and imagine possible alternative scenarios c) this of a mediator with both relational skills and a accurate perception of local communities dynamics. The consultant encourages the project manager and stakeholders to think creatively and to organize the overall communication process. For this purpose several instruments have been developed. Implementation of the ESTEEM method runs for 6 months, but actual needed men hours is much less. During the process the consultant and project manager meet several times (about 8 times in total) and the consultant meets with several key stakeholders early in the process (about 5–8 stakeholders). Later in the process a workshop is organized to engage with a larger group of stakeholders (about 20–30 stakeholders). Depending on the number of stakeholders and issues identified the labour required to perform all tasks is expected to vary between 250–300 h for an experienced consultant, 30–60 h for the project manager, 8–16 h for the key stakeholders and 6–12 h for the larger group of stakeholders.[6] In this section we briefly discuss the six steps, while in the next section we discuss in more detail examples of testing and evaluating ESTEEM in one of the cases.

3.1. Step 1: project past and present

The first step is to document and collect information about the project for later analysis. Because the method is based on interaction between a consultant and project manager, the consultant clearly needs to get a thorough understanding of the project. For the project managers it is a good opportunity to systemize and take a distance from the project. Step 1 is performed through a series of meetings between the consultant and project manager. Together they a) write a project narrative about the past of the project; b) derive moments that were crucial in project development ("defining moments"); c) make a context table that shows current barriers and opportunities as perceived by the project manager; and d) make an actors table that shows which actors have been, are currently or might be relevant in the future of the project.

[6] Note that these numbers are based on limited experiences and might vary largely for new projects.

3.2. Step 2: vision building

How to anticipate potential societal acceptance problems before they even occur? ESTEEM follows the logic of articulating future expectations and vision building to identify potential conflicts. In step 2 the consultant, project manager and stakeholders draft several social network maps and narratives, but they are not yet confronted. First, in a semi-structured interview the consultant and project manager draft a social network map of the present, showing how the project manager sees and interprets the project and the current world surrounding it. In another semi-structured interview they also draft a future network, which shows how the project manager thinks (or would like) the world (and the project) to look like in about 10 years time. These maps are accompanied by one or more fictional newspaper articles to be published in 10 years time in a local newspaper, in which the project manager reflects on project developments. A title summarizes the main theme of the project manager's vision. The vision (consisting of the maps, narrative and title) are then discussed in a series of semi-structured interviews with selected stakeholders. Prior to the interview the consultant sends the vision of the project manager to the interviewee. In the interview the stakeholder is asked to react on the project manager's vision and to articulate on what issues they agree or disagree and how they envision a different future for the project. After the interview the consultant draws a new narrative, network map and vision title for each stakeholder. The consultant sends them for review back to the stakeholder. Step 2 thus produces a number of different visions on the future of the project.

3.3. Step 3: identifying conflicting issues

The next step in the process confronts the collected expectations and visions and analyses points of convergence and divergence. What are the major points of agreement/disagreement that could potentially lead to further support or opposition to the project in the future? In step 3 the consultant addresses these questions by listing and describing the issues at stake in a "conflicting issues table". The table is discussed with the project manager in a face-to-face meeting. The project manager is then asked to rank the different issues in an "issues ranking table" and an "issues ranking graph". The table and graph are representations of the project manager's view on the importance and urgency of the different issues.

3.4. Step 4: portfolio of options

Step 4 is concerned with devising how to improve the project acceptance by reviewing a variety of solutions for the issues identified in step 3. Which pieces of the project or project context can be modified to raise the acceptance level of the project? In this step the consultant and project manager engage in a dialogue in one or two meetings to identify potential solutions with two instruments. The first one is the "issues-solutions table", which provides a semi-structured way to think about different types of adaptations to the project or context for each issue identified in step 3. The second instrument is a "solutions ranking table", in which the project manager is elicited to rank the different solutions.

3.5. Step 5: getting to shake hands

The aim of step 5 is to open up the process to a larger number of stakeholders and discuss in a wider setting the different issues and solutions identified. This task is performed in an interactive workshop, in which a stakeholder group of about 20–30 people can react to and vote on the different issues and solutions, but also bring new issues and solutions to the discussion. The latter is extremely important, because many stakeholders in the workshop are able to participate in the project for the first time. They can have different expectations about the project, which have not yet been included. The workshop is therefore designed as open as possible to allow for any discussions or feedback to emerge. Different types of workshops are distinguished within ESTEEM, depending on the requirements and characteristics of the new energy project. After the workshop the consultant produces a descriptive workshop report and sends it to all participants.

3.6. Step 6: recommendations for action

The final step of ESTEEM is oriented towards acting and planning. In the first part of step 6 the consultant compares the outcome of step 5 (solutions identified by the stakeholders) with the outcome of step 4 (solutions identified by the project manager). As a general rule all solutions mentioned by both the project manager and the stakeholders as well as solutions mentioned by the stakeholders alone are taken into account for further processing. In the second part of step 6 several action plans are derived in cooperation between the consultant and the project manager including a short-term action plan, a collaboration plan, a monitoring plan and a communication plan. The ESTEEM process ends with an evaluation of the process, in which the project manager is interviewed to articulate what he or she has learned from the process.

The process of six steps is straightforward and linear. While this was initially thought of for analytical reasons and structuring the process, our actual experience is that the steps were indeed performed in a linear fashion. There was no major "going-back-and-forward" between the steps. There is however no inherent obstruction in ESTEEM to take a more dynamic approach when the project demands it. Also, when a project manager and consultant have gone through the first round of ESTEEM they might also decide to do another full

Table 1
Sample of the defining moments table of the ZEPP project.

Data	Description of the moment	Description of cause	Internal or external cause	Internal consequences	External consequences
Dec 2001	Feasibility study	Necessary study to review if the ZEPP was viable	External/internal	Idea proved feasible, which led to continued project development	Increased trust in project by potential financiers and partners
2004	Refusal of the Ministry of Economic Affairs to implement feed-in tariffs for ZEPP-like technologies	Feed-in budget was depleted and there was debate about its continuation	External	Delay of project implementation	Sense of urgency for project within Economic Affairs decreases

round or redo part of the process. This can be useful after parts of an action plan have been implemented to verify if the project has gained societal acceptance or when new controversies have emerged.

4. The example of a zero-emission power plant

ESTEEM has been tested in a zero-emission power plant (ZEPP), planned in the town of Drachten in the Netherlands. The ZEPP has been in planning since 2000 by SEQ, a small company that aims to develop and implement power plants using innovative combustion technologies with underground carbon dioxide (CO_2) storage. The ZEPP in Drachten is to be constructed above an almost depleted natural gas field. The power plant is going to use oxyfuel technology, which combusts natural gas with pure oxygen instead of air. The result is a plant that produces (almost) pure CO_2. The CO_2 is pumped into the natural gas field below, which simultaneously enables the extraction of the remaining natural gas. The result is a closed cycle of natural gas extraction and underground CO_2 storage. Hence, the plant is called a zero-emission power plant.

ESTEEM was applied in the ZEPP project by a team of three researchers from the Energy research Centre of The Netherlands, acting as "consultants" in the ESTEEM process (referred to as "ECN consultants"). They approached the project manager of the ZEPP early 2006 with the offer to participate in the Create Acceptance project. As initiator of the ZEPP project and co-founder of the SEQ company the project manager had been closely involved from the start of the developments and had good reasons to participate. At the time there were many debates between opponents and advocates of CO_2 storage technologies about its desirability and its role in combating climate change. Moreover, not much attention had been paid to consultation with local stakeholders in Drachten and surroundings and the project manager felt this was an important issue to address. Early 2007 the ECN consultants and project manager took the first step in the ESTEEM process.

4.1. Step 1: project past and present

The first step of ESTEEM was performed through a series of three meetings between the ECN consultants and the project manager. In the first meeting the ECN consultants interviewed the project manager using a semi-standard list of questions developed by the Create Acceptance team. The three ECN consultants used the interview results to construct the narrative of the ZEPP project–a brief historical description of project developments since the late 1990s–and the defining moments table. A sample of the defining moments table is presented Table 1. It lists a number of moments that were crucially important in the developments of the project and some characteristics of those moments. For example, in 2004 the Ministry of Economic Affairs refused to implement a special "feed-in tariff" for CCS technologies. A feed-in tariff is a subsidiary bonus on top of electricity market prices, which does exist for renewable technologies like wind- and bio-energy. The budget for feed-in tariffs was more or less depleted and there was debate about the continuation of this form of support. This defining moment happened external to the project, but caused a major delay of project implementation, because new finances had to be sought. However, it also put CCS higher on the internal agenda of Economic Affairs (Table 1).

The ECN consultants sent the narrative and defining moments table to the project manager for review. Minor adjustments were made in a second face-face meeting and a start was made to develop the context and actors table (and finished in the third meeting). To fill out the context table the ECN consultants and project manager debated the question: which barriers and opportunities arise from the context of the project. They then categorized them into technological, policy, socio-economic, cultural

Table 2
Sample of the actors table.

Identification		Interest and power			Communication	
Name	Role of actor	Interest in project	Available resources	Channels of influence	Acquainted with project?	Access to project information
SEQ	Project coordinator	Expansion to mid-size energy company	Finance, employees	Decision and control through ownership	Yes, very much	Direct
Ministry of Environmental Affairs	Licensing agent	Possibility to meet climate objectives	Subsidy funds	Controls decisions for subsidy granting	Medium	Face-to-face discussions with SEQ

Not all features (columns) are included.

and geographical dimensions and attached some important features like the term on which the barrier or opportunity was expected to become relevant, the level (local, national or international) and the importance for project development and continuation (low, intermediate, high, go-no-go). A similar approach was taken for the actors table. Table 2 shows a sample of the actors table. In total 36 organizations and individuals were identified and throughout the process more actors were added when necessary. One important actor was the Ministry of Environmental Affairs, because of its role in enabling the required licenses. The ministry controlled also several subsidy funds, which it could direct to projects for meeting climate objectives. The project manager had contacts with several individuals in the ministry and he judged their general acquaintance with the project medium.

The first step resulted in a large amount of information and the ECN consultants now had in-depth knowledge about the project. An intermediate evaluation talk with the project manager showed that he had enjoyed the first step. It had helped him to take a step back from the project and reflect on what he had been doing the last years. It also raised a lot of expectations about the steps to come.

4.2. Step 2: vision building

The next step in the ESTEEM process started with a meeting to construct the project manager's vision on the project. Following the ESTEEM prescriptions the ECN consultants drew two social network maps (one current and one future) and two narratives, in which the project manager was asked to (fictionally) think back from 2010 and 2015 on how project development had progressed until then. This was an interesting endeavor. Thinking in terms of a future newspaper article and a future social network helped the project manager to creatively imagine the future and let go of his immediate problems in and perceptions of the present. The social network exercise made explicit which elements of the project still had to be realized and whom the project manager thought was going to play a role in the future. To allow a flexible approach and stimulate broad discussions it was decided to include important non-human developments and facts in the map.[7] The newspaper article elaborated on these roles and described relevant external developments. It showed how the project manager expected to realize a successful project. In particular the project manager envisioned the need for more and better connections with actors representing social concerns as well as market actors. Until then he had mainly been working with technology and policy actors. His vision was summarized in a title called “Clean energy started in Drachten” (Fig. 2).

The next step was to decide which key-stakeholders to involve in the ESTEEM process. The ECN consultants made a proposal for the selection, using the information from the actors table and a set of general criteria developed by the Create Acceptance partners. The final group of key-stakeholders was made up of both advocates and critics of the project and stakeholders with different backgrounds such as national policy actors, technology actors, general interest and environmental actors, local policy actors and neighboring actors. The ECN consultants performed interviews with seven actors, in which they discussed the project manager's vision and, on the basis of the interviews, developed different visions associated with each stakeholder. Table 3 summarizes the different vision titles. For example, stakeholder 1 was critical towards the project and in particular it's technological feasibility. This stakeholder envisioned a long period of experimentation and emphasized uncertainties regarding technological challenges.

Fig. 3 gives an example of how a social network mapped looked after adjustment to a stakeholder desire, in this case a local entrepreneurial foundation. This stakeholder argued for much more embedding with local entrepreneurial activities and envisioned a strong connection with a locally planned bio-energy plant as well as a widening of a local canal for improving transport capacities to the local industrial site. Even CO_2 transport by boat was one of the envisioned options.

Step 2 was evaluated positively by the project manager. The instruments such as the network maps and newspaper articles provided a useful method to imagine the future and to provoke discussion and debate with stakeholders. Both step 1 and 2 were quite labor intensive and demanded several meetings, but now that all information had been collected, it turned out that both steps formed a good basis for further work in the ESTEEM process.

4.3. Step 3: identifying conflicting issues

In the next phase of ESTEEM focus shifted from collecting to analyzing and comparing the different visions. The ECN consultants performed the first part of the analysis (i.e. the conflicting issues table). In a meeting with the project manager the results were discussed and, when necessary, adjusted. A large excel sheet was constructed to collect the 8 visions and divide, categorize and analyze along different dimensions including technology and infrastructure, economics, environment, society and policy. This exercise resulted in 13 issues that could become potential controversies (C) in the (near) future of the project and 7 opportunities (O) that the project could capitalize on to improve future societal acceptance. One controversy for example was related to expectations about technological development. Some stakeholders had questioned the optimistic reasoning of the project manager regarding the development of the innovative gas turbine to be used in the plant. This could potentially lead to withdrawal of important stakeholders. Another controversy had more local characteristics: in its current design the power plant would produce more heat than it could use or sell and a cooling tower was foreseen as a possible solution. A stakeholder raised questions whether a tower would be desirable from a visual perspective. A third controversy was related to safety precautions for CO_2 storage. What risks were associated to CO_2 leakages and who would be accountable in the long term? Opportunities were equally

[7] Including non-human actors build upon previous work in the Socrobust tool and connects with actor-network theory as developed by Bruno Latour, Michel Callon, John Law and others.

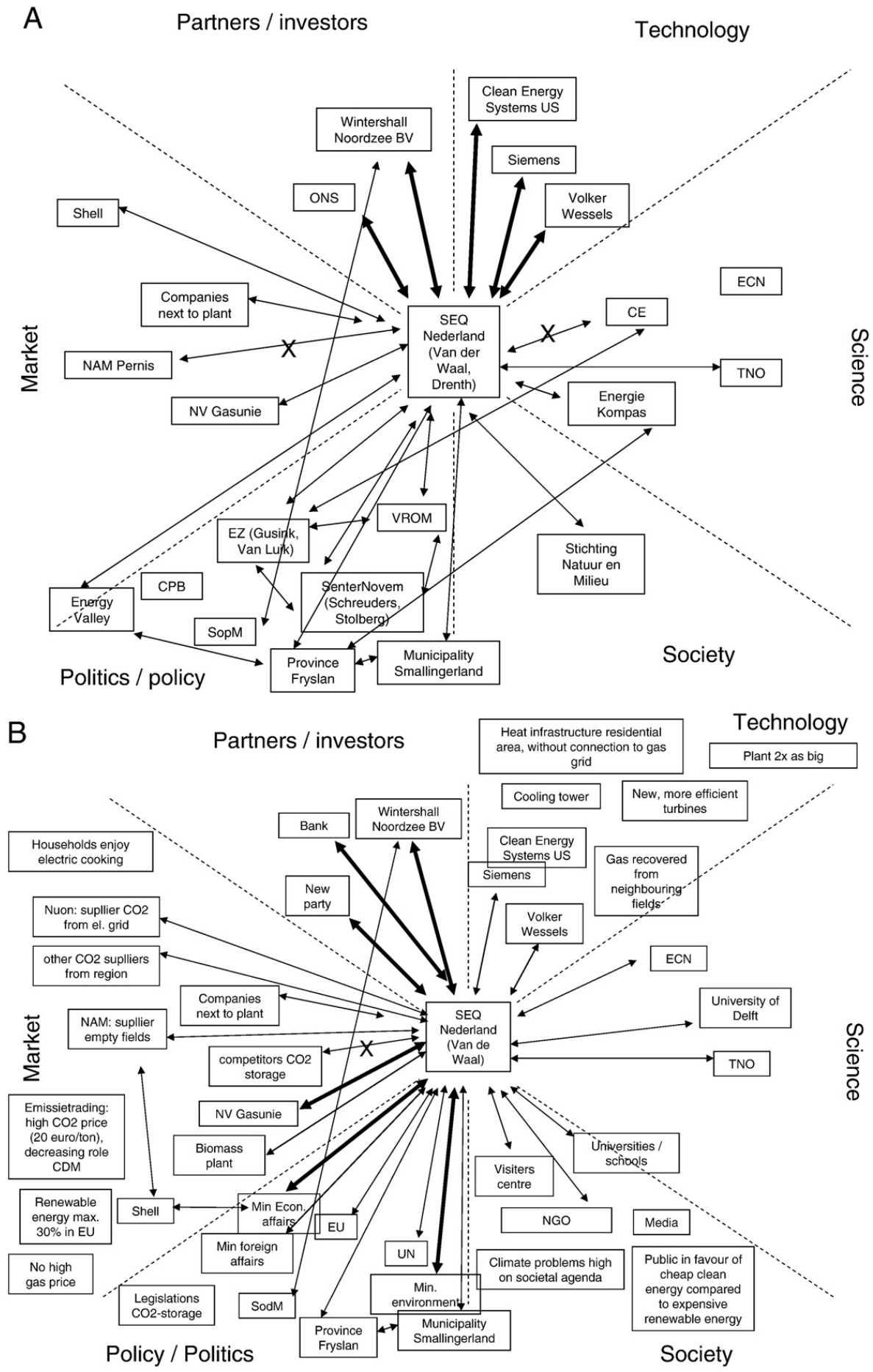

Fig. 2. The project manager's vision on the present and future of the ZEPP project.

Table 3
Overview of stakeholder vision titles.

Project manager	Clean energy started in Drachten
Stakeholder 1	Long-term demo project huge success
Stakeholder 2	Continuous critical assessment leads to success
Stakeholder 3	Important improvement for environment
Stakeholder 4	Thinking in opportunities
Stakeholder 5	Quick starter of regional economic development
Stakeholder 6	Columbus among zero-emission power plants started in Drachten

recognized. One stakeholder, for example, argued that fruitful collaborations could be sought with a planned bio-energy plant on the same industrial site. There were potential opportunities for joint heat supply or setting up a joined information centre on clean energy.

The list of issues was discussed in a meeting with the project manager. He was then asked to rank the different issues according to their significance and urgency, each on a scale of 1 to 5. The ECN consultants also asked him to think about solvability: to what extend did he expect the controversies to be easily solved or the opportunities to be easily capitalized. This resulted in an "issues ranking table" (Table 4 is a sample). The table is an indication of what issues are the most important issues to solve, and which have a lower priority. For example C1 refers to the discussion on whether or not the required innovative technology would be developed in time. The project manager decided that the urgency of this issue was medium, because he was planning to build the plant in difference phases, starting with available technologies and implementing new ones later on when available. Its significance, however, was rated high, because the long-term economic feasibility of the plant depended very much on applying innovative combustion technology. O2 refers to the opportunity to connect the CCS plant with a locally planned bio-energy plant to which the project manager attached different urgency and significance numbers. The table was also visualized in a graph, grouping the issues

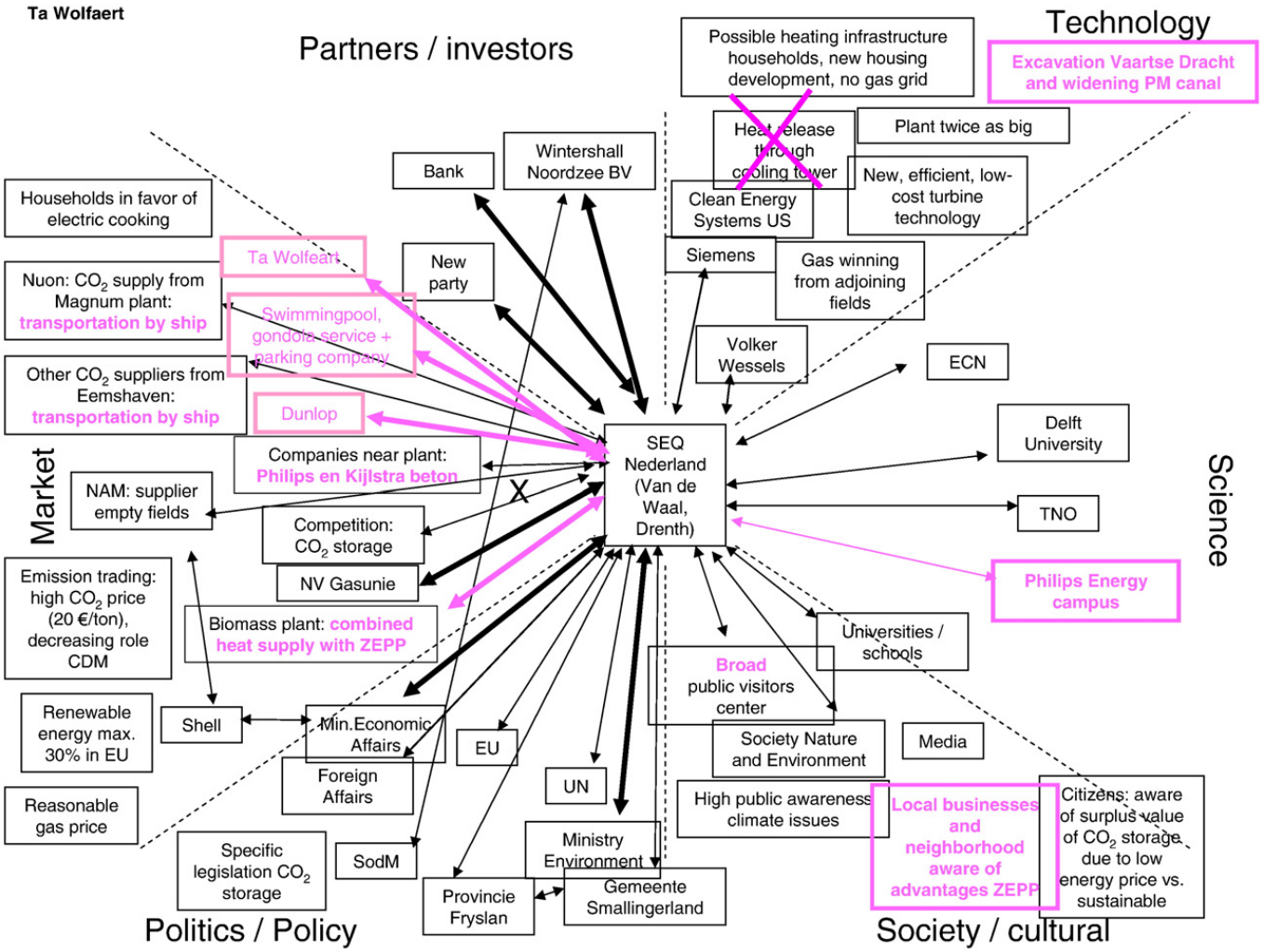

Fig. 3. Visualization of a stakeholder vision.

Table 4
A sample of the issues ranking table for the ZEPP project.

Ranking table	Urgency (1 = low, 5 = high)	Significance (1 = low, 5 = high)	Weight ($U \times S$)	Solvability (low/average/high)
C1	3	5	15	high
O2	2	4	8	high

in four segments (low urgency, low significance; low urgency, high significance; high urgency, low significance; high urgency, high significance).

Step 3 was a useful exercise for structuring the information collected in step 1 and 2. The formal way of comparing visions and ranking issues produced a rich set of potential controversies and opportunities that could be further analyzed in step 4 and used in the stakeholder workshop (step 5). This formal way of analysis also connected very well with the engineering background of the project manager, who found the ranking exercise an extremely valuable one.

4.4. Step 4: portfolio of options

The aim of step 4 is to think about possible solutions to increase project acceptance. This is done by imagining solutions to deal with the issues identified in the previous step. Following the ESTEEM process the ECN consultants could use a simple table to help the project manager do this (see Table 5). The table stimulates the project manager to think about different types of solutions. An obvious solution is to technically redesign (parts of the) plant to get a better fit with it or realize a change in the context (e.g. move it to a different location). But this was not always possible or desirable from the project manager's point of view. Therefore other types of solutions could be identified, including knowledge gap reduction and taking financial measures. A rest category was included for solutions that did not fit the previous columns. Table 5 shows a sample of the "issues-solutions" table that was produced for the ZEPP plant. For example, to deal with the issues related to different expectations about the technological development, the project manager decided he could undertake several solutions. He could make the plant "upgrade ready" instead of waiting for the required technological development. He realized he could also aim at getting a better insight about the current status by continuous contact with all suppliers and better informing stakeholders about this. Another strategy would be to provide financial incentives for trying to speed up technological development of the gas turbine, or in case of delayed supply try to contact other potential suppliers.

The second part of step 4 is the ranking of the different solutions according to the preference of the project manager. This instrument was not used in the case of the ZEPP. It turned out that too much detailed information was required that the project manager could not or did not want to provide. This included information such as expected costs and benefits of a solution, which could be potentially strategic information. More generally, strategic behavior of a project manager or project stakeholders can be a serious pitfall in the overall ESTEEM process. We will come back to this in the conclusions.

4.5. Step 5: getting to shake hands

In the fifth step ECN consultants organized a stakeholder workshop for a wider group of participants. In the ESTEEM process three types of workshops are distinguished: a one-day project partners workshop, a one-day stakeholder workshop and a two-day stakeholder workshop. The first workshop is in particular suitable for projects that are in an early development phase and where project partners themselves have not yet a clear view on the future of the project. The second and third type of workshop are suitable for projects that have already evolved into a more concrete project where partners have reached some agreement on the project's future and now aim to broaden their views with stakeholder inputs. In the ZEPP case we chose a one-day workshop for practical reasons, i.e. to limit the amount of resources and time required by the participants. This required a thorough information effort before the workshop to make sure all participants were sufficiently knowledgeable about the project's facts and figures (such as technical operation, history of the project, location, etc). In a two-day workshop this can be done in a collective effort with all participants present.

The first organizational step was to select the participants. The ESTEEM manual provides several criteria for this task. An important criterion is to not only include advocates, but also (potential) criticasters or opponents to the project. Next we

Table 5
Sample of the issues-solutions table for the ZEPP.

Issue	Equipment/context improved adaptation	Knowledge gap reduction	Financial incentive	Other
Technical design (not) ready in time	Make plant upgrade-ready for technical improvements	Continuous contact with all suppliers	Provide extra financial incentive to accelerate development	Seek other suppliers in case of delayed supply
		Informing stakeholders on state of affairs regarding technological development		
Cooling tower	Integrate cooling tower into design so that it is no longer visible	Investigate additional heat demand		

Table 6
Example of theme discussed at the stakeholder workshop.

Theme	Local benefits
Explanation	How can local benefits be optimized?
Keywords	• Build cultural centre next to the plant • Involve local companies • Build company headquarters in municipality • …

considered to include a wide variety of stakeholders representing different social groups such as local and national policy actors, technology actors, local citizens, scientists and NGO's. Finally, we made sure to involve newcomers to the project: actors that did not yet have or had an opportunity to voice their concerns but might become important stakeholders in the future. Eventually 32 stakeholders were invited.

The participants received an informative dossier before the workshop. This dossier included–besides some practical information–a list of five themes to be discussed in the workshop. This list of themes grouped and summarized the 20 issues derived from step 3 and contained the theme name, an explanatory question and some keywords and examples. The following themes were selected:

- Local benefits (How can local benefits be optimized?)
- Local (negative) impact (How can negative impact be minimized?)
- Technological and legal issues (How can technological and legal uncertainties be dealt with?)
- Relationship with sustainable energy (How can the development of CCS be aligned with the development of sustainable energy?)
- Economic aspects (How can economic risks and uncertainties be dealt with?).

Table 6 shows an example of the local benefits theme.

The workshop started in the morning with a get-to-know-each other and general introduction to the ESTEEM process. The project manager gave a presentation about the ZEPP plant and the ECN consultants lined out the background of the workshop and the ESTEEM process. In the afternoon, the participants were divided into three groups. Three ECN consultants facilitated the groups and in each group a SEQ representative was present. Each group was asked to discuss the five themes and develop ideas about how to deal with the five selected themes. What solutions would they appreciate or support? Which ones would they not support? Were there other themes not yet addressed that needed attention? The discussions and debates in the group sessions were lively and produced a large number of creative solutions. In a final plenary session each ECN facilitator provided feedback to the other groups. They summarized the discussions and debates and (using flip-overs) showed which solutions the group had come up with. Participants from the other groups were invited to react and provide feedback. The stakeholder meeting ended with a short trip to the location where the ZEPP was planned to be constructed. After the workshop a descriptive workshop report was send to all participants based upon the group session outcomes and minutes taken during the plenary sessions.

Step 5 proved to be a vital part of the ESTEEM process. Although it had the form of a regular stakeholder meeting the specific preparation during the previous steps and the resulting list of themes and issues enabled a concrete and lively discussion during the workshop. It favored the process of “alignment” of expectations between the various stakeholders necessary to increase the

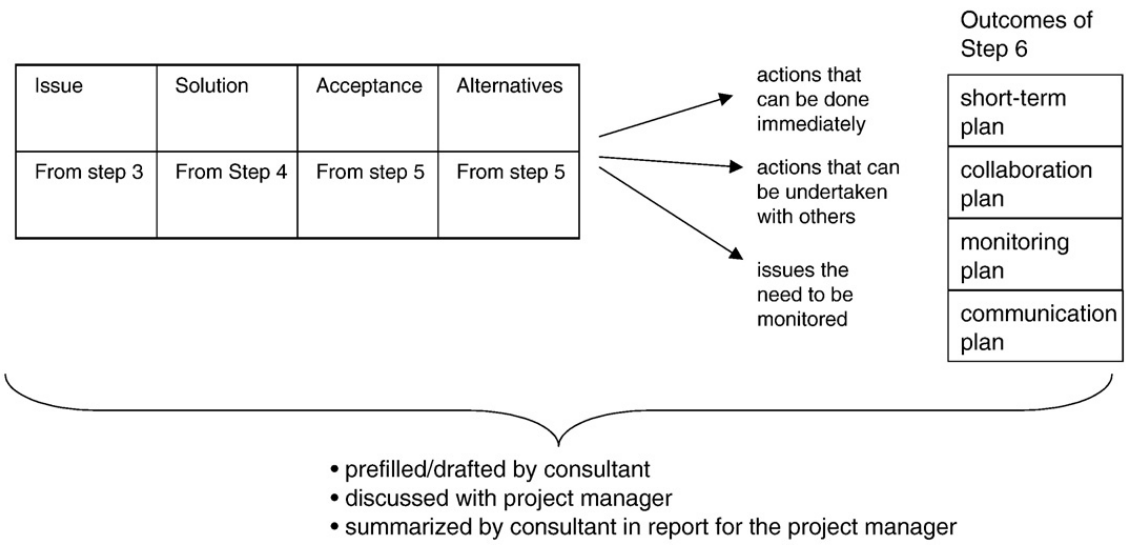

Fig. 4. General process scheme for step 6: action planning.

Table 7
Sample of the comparison of project manager and stakeholder solutions.

Issue	Project manager solutions	Stakeholder solutions	Types of action(s) required	Does it require collaboration	Feasibility
Role of information centre	Broaden the role of the information centre	Add exhibition room for local artists to information centre	Consult municipality and cultural organizations for possibilities	Municipality, cultural organizations	High
Financial participation of citizens		Offer people in municipality inexpensive electricity	Investigate possibilities with associated energy company	Energy company	Low

project acceptance. The project manager evaluated the step very positively. It made him aware of the wide variety of stakeholders that were involved in the ZEPP plant and he made several new contacts during the meeting. Overall he had the impression that many if not all stakeholders were in principle in favor of the ZEPP plant. This fitted the impression from previous steps: although many potential issues had been identified in the previous steps, they were of the caliber that could be solved in the coming months. But it also raised new questions. Complying with these expectations would take considerable (financial) effort and could even include a serious re-investigation of the short-term technical and economical feasibility of the plant.

4.6. Step 6: recommendations for action

The last step consisted in translating the results from the previous steps in an action plan for the project manager. The process involved comparing the results from the desirable solutions identified by the project manager (as developed in step 4), with the solutions developed through the participatory process in the stakeholder workshop. The general process scheme is shown in Fig. 4.

ECN consultants firstly compared the solutions developed in step 4 and step 5. As a general rule, all solutions mentioned by both the project manager and the stakeholders as well as solutions mentioned by the stakeholders alone were taken into account for further processing. Several additional characteristics were identified for each issue:

- the type of actions required
- whether or not it would require extensive collaboration
- the expected feasibility of the action.

This first comparison and organization exercise resulted in a total of 45 solutions for further processing. The following table provides a sample of two solutions. For example, both the project manager and several stakeholders argued that an information centre with a variety of functions including a local exhibition room would be a nice addition to the project. This required the project manager to consult with the municipality and local cultural organizations to explore possibilities. The feasibility to realize this solution was considered high (Table 7).

In the next phase of step 6 the ECN consultants organized the solutions further into a table ("the capacity for action table") (Table 8). This table distinguishes different solutions into three different types of activities, i.e. 1) activities that can be undertaken today without major collaboration, 2) activities that require substantial collaboration with other actors and 3) activities that are targeting the long-term and/or monitoring activities. For example, taking care of an "honest" communication plan was something the project manager could do immediately and without any significant dependence on others. However, developing courses about new energy technologies would require substantial cooperation with for example local schools and regional universities. In case of the discussion on the role of the government in the construction of a CO_2 infrastructure it was decided that this could not be controlled by the project manager. He could however monitor the discussion and take part in the national dialogue.

The final part of step 6 was to make the different activities more concrete by discussing with the project manager the required sub-activities needed and distinguish potential communication channels with external actors to perform the activities. These discussions were summarized in different tables representing the short-term action plan, the collaboration plan and the long-term and monitoring plan. Table 9 provides a sample of the collaboration plan, which shows required activities and communication channels for realizing a multi-functional information centre and developing courses on new energy technologies.

Step 6 was finalized with an evaluation meeting between the ECN consultants and the project manager. This meeting existed of a short interview to assess what the project manager had learned from participating in the ESTEEM process and to learn which

Table 8
Sample of capacity for action table for the ZEPP plant.

Activities that can be done today	Activities that require substantial collaboration	Activities aimed at the long term and monitoring
Take care of "honest" communication plan	Negotiate with municipality and cultural organizations about multi-functional information center	Negotiate with municipality about risk funds for potential decrease in house prices due to plant construction
Advertise additional heat supply to municipality and local industry	Cooperate with schools and universities to develop courses about new energy technologies and trainee positions	Enter into dialogue with national government about potential participation in CO_2 infrastructure development
Investigate possibility for constructing a climbing wall on cooling tower	Extend cooperation with regional energy interest organization to lobby for positive image of CCS	Develop a reliable and transparent system for monitoring CO_2 storage

Table 9
Sample of the collaboration plan table of the ZEPP plant.

Activities that require substantial collaboration	Type of recommended activities	Sub-activities and revision of current practice	Communication channels
Negotiate with municipality and cultural organizations about multi-functional information centre	Consultation and research	Elaborate various options for centre and consult municipality and local actors what they need	Face-to-face consultation
Cooperate with schools and universities to develop courses about new energy technologies and trainee positions	Collaboration with new stakeholders	Map different roles students can play in ZEPP. Seek contact with schools and other knowledge institutes	Face-to-face consultation/ local newspaper/university newspaper

parts of the process had provided him with new insights. In the ZEPP case the project manager evaluated the process quite positively. He had learned a lot from the different steps, which had enabled him to reflect on the project and enter into a dialogue with the project stakeholders. The 45 solutions provided him with a portfolio of activities that would increase the chances on a socially accepted project. He had in particular learned a lot from the stakeholder workshop and acknowledged to have underestimated the communication aspects of the process and in particular those with local stakeholders and decided to improve this in the future.

5. Discussion and conclusion

In this paper we could confirm the interest of applying the Participatory Technology Assessment line of thought to the local level of project management to enhance their societal acceptance. Building on previous lessons learned in PROTEE, SOCROBUST, SNM and TM, and adding a participatory dimension to them, the study made in the European project Create Acceptance allowed for an experimentation of a procedural method, ESTEEM, aimed at constructing a more deliberative and reflective decision making process in project management. The method was tested and evaluated to 5 different cases in Europe and this paper illustrates its application through the description of one of them, the ZEPP project of Carbon Sequestration. Although this investigation represents an exploration into relatively new grounds, a number of conclusions can be made about the methodological mechanisms involved in supporting the reflective practitioner in project management.

First, ESTEEM uses a processual and formalized structure for project managers to create a reflective space and anticipate and systematically think about societal acceptance issues in new energy projects. For the technical or economic dimensions of a project, managers have tools to help them reflect upon the coherence and consistence of their vision. ESTEEM draws on this tradition to do the same with the societal dimension of projects. Formalization to making explicit underlying assumptions is a key word here, as it is used to stimulate reflection on past and future actions, and test implicit "theories" or "understanding" used by the manager in their practice, decision and planning activities. As Schön explained, reflecting upon implicit theories used in practice contributes to form a reflective practitioner: "the practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understanding which serves to generate both a new understanding of the phenomenon and a change in the situation" [32].

It was confirmed that this approach helps a project manager to reflect on the project's history, context and surrounding social network and make explicit his or her vision on the project's future. Much of this information is not new; it exists in the mind of the project manager. Formalizing is one step towards reviewing and discussing it. The formalized structure of role playing between an "external" consultant and an "internal" project manager is a way to extract the information and provides the opportunity to further discuss and test them. It creates a reflective space on a busy project manager's agenda that otherwise tends to disappear, because regular project planning activities absorb much of the time and resources available. Without explicit attention, societal acceptance tends to be neglected, or insufficient understanding of the societal risks tend to be hold true, until managers are confronted with concrete and structured acts of resistance.

Second, the creation of a reflective space by ESTEEM is complemented with elements that resemble a participatory technology assessment (PTA) approach. There are two sides to this participatory dimension.

The first side concerns a technological project assessment through participation of stakeholders. Anticipating the societal implications of technological projects is essential but uncertain. In ESTEEM, this is done through debating on visions and scenarios of the future. This deliberative forecasting exercise is based on the confrontation of various anticipations held by different stakeholders, enriching the appreciation of "alternative routes", guiding "the trial and error" process associated with innovation management, thus reducing the "uncertainties" of this process [33]. Comparing the project manager's future with those of selected stakeholders helps anticipate potential barriers and opportunities that might rise in the future. Creating a set of newspaper articles and social networks allows a rigid comparison between different futures.

The second side of participation relates to opening a negotiation process with concerned actors early on in the project. The design stage has been designated as a favorable target for decision making about technology, as there would be much less room for maneuver once the technology is implemented and "made durable". In ESTEEM, acceptance is improved through such negotiation. Systematically analyzing, developing solutions and discussing them in a stakeholder workshop provide a space for reflection about societal acceptance issues notably by "aligning" the variety of expectations held by different actors. This exercise can be designated as a participatory (re-)design process through negotiating expectations.

Third, the participatory re-design of the process is made practical with a set of instruments and tools in step 6. This provided the project manager with a concrete portfolio of activities that would increase the chances on a socially accepted project. Many recommended activities build upon the network foundations laid down in the previous steps and are highly participatory: they require extensive participation with a variety of stakeholders. Step 6 added the necessary practical conclusions after 6 months of reflection and stakeholder participation.

Fourth, another key aspect of the methodology regards the participants' attitude, behavior and motivation. We did not investigate much about this in the present work, but our experiences suggest that it should be studied more thoroughly in the future. Opportunistic behavior can hardly be excluded. In addition, de facto asymmetries of information characterize innovation projects. The question is then to understand the implications of the different behaviors of the participants to the process of participatory technology assessment. The ESTEEM process depends on the input of the project manager and stakeholders. This makes the process vulnerable to strategic answering and acting. It is difficult to asses whether or not stakeholders and project manager are deeply involved and honest in their participation or whether they operate to reach individual interest rather then collective outcomes.

Fifth, we would like to emphasize the learning dimension of our experiment. Being framed as a step-by-step guide the ESTEEM process does not mean we aimed at a simple and straightforward tool, but rather a supportive framework for reflection, participation and learning. This involves some creativity in applying the method itself. Societal acceptance issues (and reflective and participatory exercises in general) require invention each time they emerge or are addressed in a new project. There is no easy fix for potential social resistance. Rather, it requires a constant reflective and learning attitude of a project manager and other partners in a new energy project. It requires asking questions that might lead to unwanted answers. In extreme cases it might result in moving the project to another location, do some rigorous redesigning or even to stop development at all. This is not an easy task for a project manager and his team. The reflex might be to focus on improving the communication rather than to fully accept to outcome of a stakeholder consultation process. However, many cases in the past show that taking stakeholder consultation not seriously might eventually result in stakeholders leaving the process or, worse, start articulating resistance against the project ultimately causing major delays, frustration and unwanted abandonment of the project.

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