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European Clusters for Offshore Wind Servicing

ECOWindS
Evaluation and Adaptation Report

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List of Abbreviations

AAU	University of Ålborg
DoW	Description of Work
DTU	Technical University of Denmark
ECOWindS	European Clusters for Offshore Wind Servicing
GW	Germanwind GmbH
JAP	Joint Action Plan
OEDK	Offshoreenergy.dk
OEM	Original Equipment Manufacturer
OEUK	OrbisEnergy (United Kingdom)
OWS	Offshore Wind Services
PCB	Personal Control Belief
RBV	Resource Based View of the Firm
RDC	Research Driven Cluster
RDI	Research Development and Innovation
SCM	Success Case Method
SET-Plan	The European Strategic Energy Technology Plan
SOR	Strategic Orientation
TPB	Theory of Planned Behavior
WP	Work Package
ÅUC	Ålesund University College

Executive Summary
- A Method for Evaluation and Further Adaptation of the Joint Action Plan

Background and Context

This report is a deliverable of the European Clusters for Offshore Wind Servicing (ECOWindS) project funded from the European Union 7th Framework Programme for Research and Innovation. It is part of the Work Package no. 4 “Joint Action Plan”, corresponding to the task no. 4.3 “Defining a method for evaluation and future adaptation of the Joint Action Plan” (JAP) (Deliverable no. 4.1), contributing to Task 4.4., “Revising the JAP”.

The objective of this report is first to present a system for monitoring progress of the JAP in terms of the strategic objectives and provide guidelines for adapting the JAP. The second objective is to outline a method to establish the outcome and impact of the Joint Action Plan.

The intended audience is primarily the present ECOWindS consortium, which is responsible for the evaluation and update of the Joint Action Plan (JAP) as well as the post-ECOWindS collaboration that will assume the ownership of the JAP. Secondary audience is the stakeholder community which is engaged in the ECOWindS project and uses the JAP.

Overview to the Method

The prime concern for sustainability of the JAP beyond ECOWindS project is its relevance for the OWS industry together with partner and stakeholder commitment. Precursor for relevance is continuous monitoring and updates that keep the document a living commonly accepted statement of the industry. In the long run, updating the JAP relies on committed ownership of the JAP and a committed core group of stakeholders who have clear responsibilities for key activities relating to the JAP.

Given the framework for the JAP as a plan to translate the Strategic Orientation (SOR), i.e. the goals for RDI in OWS, to concrete actions that will take the industry towards the goals, the JAP needs to be eventually adapted for one or several of the following reasons:

- Strategy and goals of the industry change
- Industry structure changes
- Capabilities change and evolve
- Actions from the JAP are accomplished
- Actions are rendered redundant by other actions and/or changing circumstances
- Actions previously not possible become possible through changes in industry structure, capabilities and/or SOR
- Actions previously not relevant become relevant due to new orientation or shift in framework conditions

We anticipate that there are drivers that affect the JAP on three levels. First the work in some of the actions potentially changes priority and feasibility of the other actions especially in the long run. Second, the usual development of the industry outside the JAP influences the competences of the enterprises, the direction of their search and priorities. Third, the gradual, or sometimes discontinuous, change in the wider business environment has an effect on the goals and priorities for the enterprises. This suggests two continuous processes that are needed for systematic update of the JAP:

- Monitoring the industry framework conditions and structure to evaluate if the current strategy and objectives are relevant
- Monitoring the progress of the JAP actions, their success and the relevance of on-going and scheduled actions for the industry

The key elements of this method are systematic collection of data long the way, following the boundary conditions of the industry and cyclical spot evaluations that draw judgment whether action is needed. The proposed high level procedure follows the well-known planning-execution or policy making cycle.

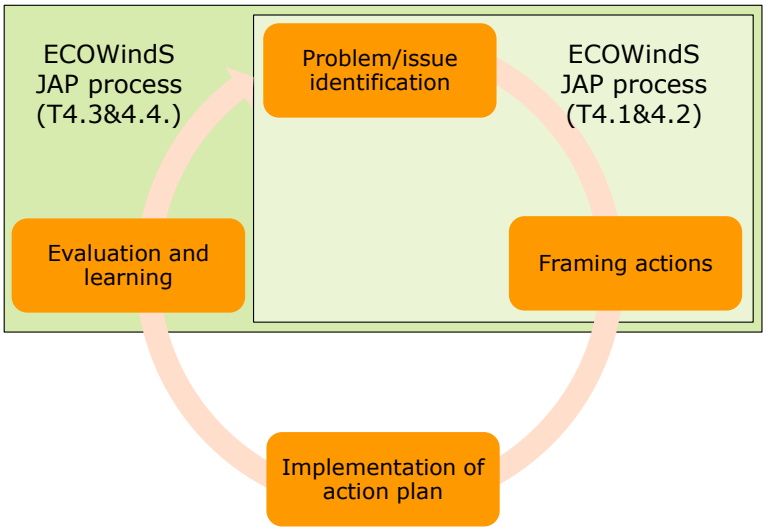

Figure 1: JAP implementation and evaluation cycle (adapted from K. A. Piirainen 2014)

The prime concern for sustainability of the JAP beyond ECOWindS project is its relevance for the OWS industry together with partner and stakeholder commitment. Precursor for relevance is continuous monitoring and updates that keep the document a living commonly accepted statement of the industry. In the long run, updating the JAP relies on committed ownership of the JAP and a committed core group of stakeholders who have clear responsibilities for key activities relating to the JAP.

The appointment of an ‘owner’ for the JAP and the evaluation/adaptation process is an important precursor for sustainability of the JAP. During the ECOWindS project, the owner the JAP and evaluation is the project coordinator, Offshoreenergy.dk (OEDK). Discussion to form a long term ‘Post-ECOWindS Collaboration’ in some form to oversee the JAP have been started during the JAP process. The organizational form of this collaboration is not set and it does not have to be limited to present ECOWindS consortium. Nevertheless it is foreseen that this Post-ECOWindS Collaboration will take the ownership of the JAP and other ECOWindS deliverables.

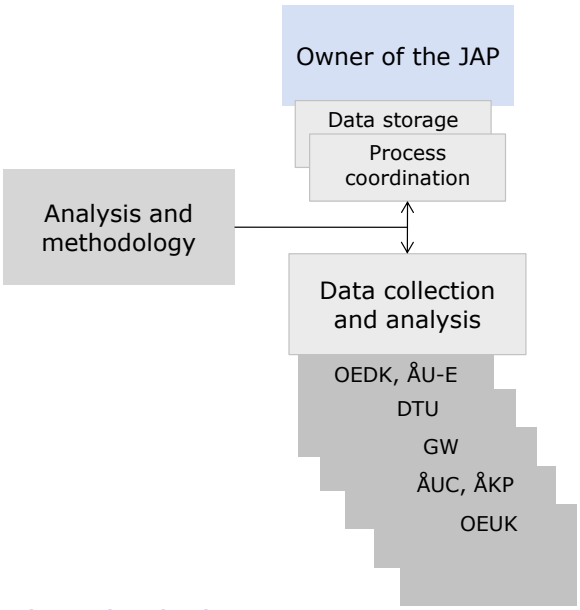

Figure 2: Organization of monitoring and evaluation

The key responsibility of the owner of the JAP regarding the evaluation and update process is to take charge for coordinating the process and follow up data gathering and recording, and trigger the analysis and update of the JAP at appropriate intervals. The analysis and methodology partner in ECOWindS is WP4 leader, Technical University of Denmark (DTU). After ECOWindS the instance in charge of analysis may be a constellation of partners from a Post-ECOWindS collaboration or an outside contractor. All the partners are responsible for contributing to data collection and documentation of their work with the JAP. These include beside the mentioned partners Germanwind GmBH, Orbis Energy (OEUK) which comprises Nautilus Associates and NWES Property Services, Ålborg University at Esbjerg, Ålesund University College and Ålesund Technology Park. In the post-ECOWindS phase this constellation partners may be different.

Because of the complexity of the interaction between the intervention and its surrounding, and the time span for the first round of evaluation, it is not expected that a black box input/output assessment will answer all the relevant questions in a way that would support adaptation. Thus we propose theory-based evaluation approach which will paint a richer picture of the effect of the JAP and also enables answering questions related to how and why did something happen of did not.

The evaluation design conforms to a general pathway for foresight evaluation proposed by Sokolova and Makarova (Makarova & Sokolova, 2012; Sokolova & Makarova, 2013), from evaluation design through identifying evaluation criteria, to data collection and analysis, and finally, reporting.

Within the theory-based framework, we use both a priori theory of change and contribution analysis with the success case method (SCM). Contribution analysis in sum is an approach that aims to constructing a contribution story based on evidence gathered on the intervention. The data collection is guided by an impact logic or theory of change, which is contrasted with the contribution story and developed long the evaluation (Mayne, 2001, 2008).

The evaluation intensifies periodically. The first round of assessment is expected roughly one year from launch of JAP in quarter 1-2 2015. The evaluation draws together the interim data collection, identifies interesting cases and collects evidence through survey, supplementary interviews and

case studies to build a contribution story, estimate the initial impact or outcome of the JAP process and extract lessons from case studies on collaboration instances.

The basis for identifying case studies for the SCM is identification and recording of collaborations. The documentation of RDI collaboration needs to be done by the ECOWindS partners as a part of day to day activities, whenever interacting with cluster members. There is a synergy between outlining new RDI collaborations and WP7 communication activities, which are routinely gathered during the project.

The data is analyzed to form a bottom-up contribution story that challenges the original impact logic. This analysis enables updating the impact logic and identifying the general factors that have contributed to success or failure. This enables critical examination of the general assumptions of the JAP and update to the impact logic and content of the JAP. The case studies further lend an insight to the boundary conditions of the industry and expectations for collaboration. The cases identify factors that contributed to success or failure of attempted actions, which enables designing action to support those conditions and contribute to replicating success stories.

Ideally the impact of JAP would be confirmed with industry statistics and/or self-reported figures of number of collaboration instances before and after the ECOWindS JAP process. However, due to the lead time to launch of new innovations, market shares or other financial statistics will likely not show any effect during the evaluation period. However, it is useful and informative for the cluster organizations to establish a monitoring database on industry collaborations and innovations for further reference to enable following the impact and to inform cluster management.

The responsibilities in performing the evaluation are as follows. The JAP owner will coordinate the process. DTU is responsible for the evaluation methodology, instruments and protocols for data collection together with the other partners. The on-going collection or documentation of RDI collaboration is the main responsibility of the partners within their own regions. DTU is in charge of technical implementation of the evaluation survey while the partners are responsible for identifying respondents, providing contacts and distributing the survey. Again for the supplementary interviews, each partner is responsible for identifying possible interviewees based on the documentation of the collaboration instances. The interviews are conducted jointly by DTU and all of the partners with the same question template, recorded and/or noted down for further analysis. The following table details responsibilities of partners

Implications to the Adaptation of the Joint Action Plan

In anticipation of the evaluation results, we outline some scenarios for adapting the JAP. In interpreting the results, three things should be separated, 1) the impact of the JAP and ECOWindS, 2) the content of the JAP and 3) the effect of framework conditions. The reason is that the impact is a product of involvement in the process, stakeholder engagement and use of the JAP, as well as the actual content of JAP. We expect that stakeholder communication plays a role together with the other factors outlined in the impact logic. The following schema separates the dimensions of engagement and reactions to the evaluation findings. Impact of the JAP is measured in short by its recognition in the stakeholder group but more importantly in the number of collaboration initiatives that would not have been started without the JAP process and/or document (attribution) or that have been influenced, reinforced, speeded up prioritized or otherwise affected by the JAP process or document (contribution).

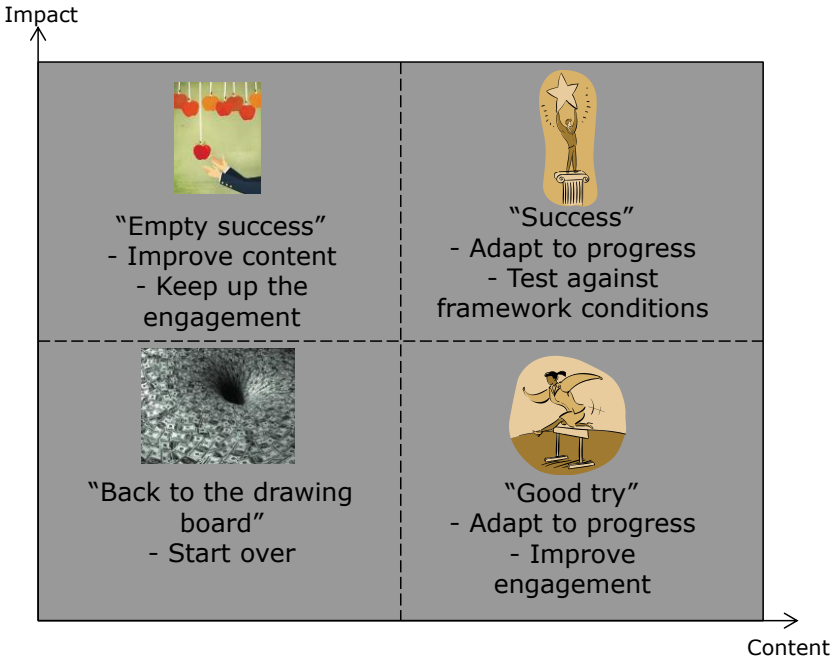

Figure 3: A Scheme of interpreting the evaluation findings

Another aspect then is interplay between the framework conditions of the industry and the JAP. The JAP relies on the assumption that the industry structure, capabilities and business environment stay stable to a degree. It is expected that some actions may change, become redundant or unrealistic when the industry move forwards. These results inform the implementation guidelines for the JAP and give rise to adaptation to the actions and/or their timing. The adjustments include the path, timing and also the actions. Additional monitoring is needed to check whether the assumptions underlying the JAP still hold.

Due to normal development or sudden events related to e.g. energy policy and regulation over the life time of the JAP, the industry boundary conditions and assumption behind business models may become challenged. This situation may become apparent either in evaluation of JAP or during the normal course of business in the cluster through the monitoring activities. In the case of such an eventuality, there may be a call to update the SWOT analyses, and at least the Strategic Orientation, i.e. strategic goals, as well as the JAP together with or consulting the stakeholders. This larger update also calls for examination of the impact logic, but not necessarily the monitoring and evaluation method.

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1. Introduction

Overview to the Work Package and Task

This report is a deliverable of the European Clusters for Offshore Wind Servicing (ECOWindS) project funded from the European Union 7th Framework Programme for Research and Innovation. It is part of the Work Package (WP) no. 4 "Joint Action Plan", corresponding to the task no. 4.3 defining a method for evaluation and future adaptation of the Joint Action Plan (Deliverable no. 4.1), contributing to Task 4.4., revising the JAP.

The method is designed by Kalle A. Piirainen (DTU), with contributions from the ECOWindS partners. The objective of this report is to first to present a systematic method for evaluation of the outcome and impact of the Joint Action Plan. Second objective is to enable monitoring progress of the JAP in terms of the strategic objectives and provide guidelines for adapting the JAP according to the findings.

The intended audience is primarily the ECOWindS consortium, which is responsible for the evaluation and update of the Joint Action Plan (JAP). Secondary audience is the stakeholder community, who are engaged in the ECOWindS project and use the JAP.

The report is structured as follows. The first section introduces the ECOWindS project and the context of this Evaluation and Adaptation Report. The second section explains the systematic approach for evaluating and adapting the Joint Action Plan. The third section outlines the methodological design of the method and interpretation of the findings to adapt the JAP. The fourth section closes the report with concluding remarks.

Overview to ECOWindS and the JAP from the perspective of Evaluation and Adaptation

The context of this evaluation is Offshore Wind Service industry (OWS), which is a subset of the offshore wind industry, as it excludes the manufacturing of wind turbines, generators, foundations and other equipment. OWS is defined within the project as the industry that executes the operations necessary for installation and operation of an offshore wind farm from the component manufacturers' factory door to end-of-life of the farm. Thus the main components of OWS value chain are component logistics and assembly; installation of the components of a farm; operations and maintenance of the farm[1] and.

Characteristics of the OWS include that it is a relatively young industry. The first commercial scale offshore wind farm demonstration called Vindeby was installed in 1991, but large scale deployment started only in the wake of the European Union SET-Plan which provided binding targets for renewable energy production. Thus the industry has been in existence under a decade. The offshore wind industry is organized on one hand around wind turbine manufacturers who provide a keystone technology and often act as network engines in the wind farm value chain, and on the other wind farm developers and operators who bear the financial responsibility for wind farms. The OWS value chain in contrast is rather scattered in between component manufacturers and large operators. The second characteristic that follows from the first and the structure of the whole offshore wind industry is that OWS as a whole lacks strong ties between enterprises, the OWS enterprises come from different industry backgrounds, and institutions that identify with OWS specifically are lacking. Additionally the OWS enterprises are relatively small and lack bargaining

[1] Due to the relatively short life of the OWS industry, the ECOWindS decided to focus on the front-end of the life cycle, and repowering or decommissioning are excluded from the analysis.

power, influence and resources compared to turbine manufacturers, other original equipment manufacturers (OEMs), and especially wind farm developers and operators.

The object of evaluation is Work Package no. 4 of the ECOWindS project, and in the narrowest sense Deliverable 4.1 the JAP. The overall goal of the project is to support development of the Offshore Wind Service industry (OWS) through stimulating research, development and innovation (RDI) in four regions around the North Sea. The regions, or Research Driven Clusters (RDCs), are South Denmark (Region *Syddanmark* Southern Jutland), East of England (East Anglia, Counties of Cambridge, Suffolk and Norfolk), North West Germany (Bremen-Bremerhaven region, federal states [*Bundesländer*] of *Bremen, Hamburg,* and *Niedersachsen*, and as an extended region *Schleswig-Holstein, Mecklenburg-Vorpommern* and *Nordrhein-Westfalen* as well) and Møre in West Norway. The regions are represented in the project consortium by cluster organizations.

The following figure illustrates the structure of the ECOWindS project in terms of work packages. The project has three main phases, starting from the analysis of regional competences and research agendas (WP2-3), development of a joint roadmap (WP3-4), called a Joint Action Plan (JAP) and actions towards implementation of the JAP (WP5-6). While the evaluation is focused specifically on the JAP (WP4) the other activities of the project will be taken into account.

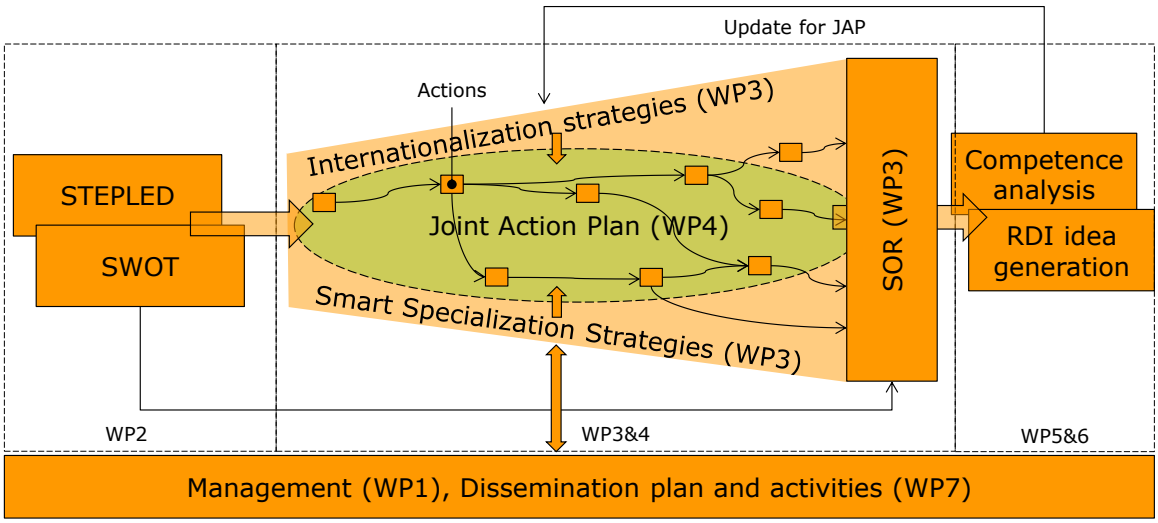

Figure 4: Project structure and Work Packages (WPs) (Author's compositions Note: figure is not completely chronological from left to right, WP3 finishes before WP4)

The following table provides an overview to the project outputs and expected outcome and impact of ECOWindS as envisioned in the project plan and Description of Work (DoW). Here the JAP plays a key role in synthesizing the first part of the project to a roadmap for the industry. The following work packages then build on the previous four to start implementing the JAP. The implicit intervention logic of the project is that involving the stakeholders to the foresight process will introduce them to prospective collaborators and raise commitment to the results, which in turn will lead to increased RDI activities and socio-economic impacts follow suit.

Table 1: Overview to outputs and expected outcomes of ECOWindS (from Description of Work, categories based on Autio, Kanninen, and Gustafsson 2008; L. Georghiou 1998)

<table>
<tr><th>Level</th><th>Input</th><th>Activities</th><th>Output</th><th>Outcome and impact</th></tr>
<tr><td>1st order additionality</td><td colspan="2">Input
Regional clusters organizations' investment to the project (working time and other in-kind)
Regional Steering groups' and other stakeholders invested time</td><td>Outputs (major deliverables)
Regional Mapping analysis of cluster regions
Strategic Orientation and Strategy and Smart Specialization Toolkit
Joint Action Plan
Competence Analysis and Cross Regional Training Platform
Assessment of RDI ideas and a Short List of RDI ideas</td><td rowspan="2">Outcome(c.f. below)
Enhanced transnational cooperation
Improve links between regional authorities, research entities and local business community
Development of regional RDI policies
Partnerships in international RDI projects
Improve internationalization RDCs
Increase visibility of the RDCs
Impact
Increased knowledge-creating partnerships and RDI activities
Increased competitiveness of the regional clusters
Thriving enterprises that create employment and tax income</td></tr>
<tr><td>2nd order additionality</td><td></td><td colspan="2">Behavioral additionality:
Recognition of new business opportunities and RDI ideas
Networking between enterprises, research institutions and regional authorities
Recognition of new (potential) partners</td></tr>
</table>

Within the overall goal of the project, the specific objectives for the ECOWindS are summarized in the following table together with the relevant indicators specified in the project's Description of Work. The overall approach is to induce networking and provide an agenda of collaboration in the form of the JAP, which indirectly contribute to the direction of RDI activities and by extension to the success of the industry.

Even though foresight is not explicitly mentioned in the project name, it has the same properties and significant foresight content, as the key aim of the project is to develop a joint vision and goals for the industry, and a common roadmap to support actions towards the goals. Further, the process is participatory and inclusive for industry stakeholders, researchers and policy makers. Thus we argue that the project qualifies as a foresight intervention for the purposes of this evaluation.

Table 2: Project objectives and indicators (from ECOWindS Description of Work, RDC refers to Research Driven Cluster)

Objectives/Indicators	New contacts between participants in the RDCs	Transnational cooperation between high-potential OWS RDCs	Incorporation of the JAP conclusions in regional strategy	New development projects including the regional authorities, research entities and local business	New cooperation between OWS RDCs by means of JAP
Enhance transnational cooperation between high-potential OWS RDCs	X	X			
Improve links between regional authorities, research entities an local business community for the development of specific regional RTD policies and partnerships in international end European projects	X	X	X		
Increase the interregional cooperation between OWS RDCs by means of a JAP				X	X
Improve internationalisation of ECOWindS RDCs			X	X	
Increase visibility of the ECOWindS RDCs and project via dissemination			X	X	
Quantitative goal	**200**	**20**	**5**	**5**	**10**

2. A Method for Evaluating and Updating the Joint Action Plan

This section presents an operational monitoring and evaluation plan to follow the progress of JAP and update it when needed. The key elements of this method are systematic collection of data long the way, following the boundary conditions of the industry and cyclical spot evaluations that draw judgment whether action is needed. The proposed high level procedure summarized in Figure 5 follows the well-known policy making or Deming cycle (Moen & Norman, 2010; K. A. Piirainen, 2014). The intended use of this system spans beyond the ECOWindS project. Thus parts this report focuses partly on present time and tasks 4.3 and 4.4 of the ECOWindS project which include the first evaluation and adaptation of the JAP within the project. However, overall the focus is on setting up a system of continuous improvement that will serve the ECOWindS Project and any Post-ECOWindS collaboration that will take up the implementation and update of the JAP.

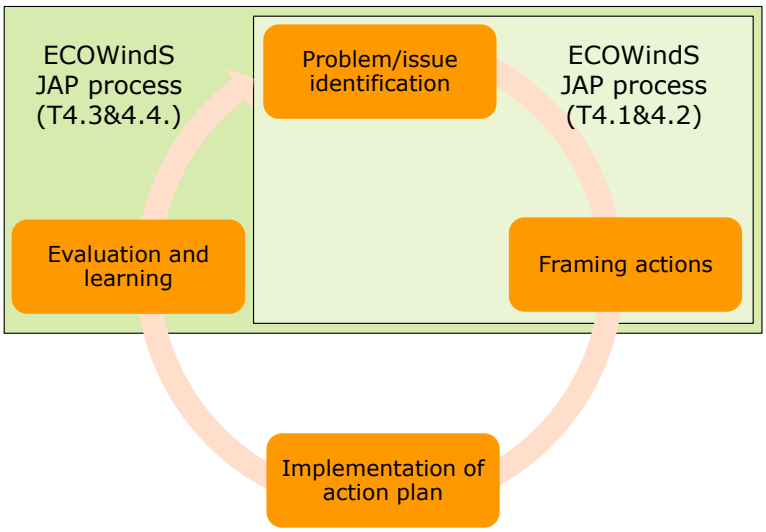

Figure 5: JAP implementation and evaluation cycle (adapted from K. A. Piirainen 2014)

Given the framework for the JAP as a plan to translate the Strategic Orientation (SOR), i.e. the goals for RDI in OWS, to concrete actions that will take the industry towards the goals, the JAP needs to be eventually adapted for one or several of the following reasons:

- Strategy and goals of the industry change
- Industry structure changes
- Capabilities change and evolve
- Actions from the JAP are accomplished
- Actions are rendered redundant by other actions and/or changing circumstances
- Actions previously not possible become possible through changes in industry structure, capabilities and/or SOR
- Actions previously not relevant become relevant due to new orientation or shift in framework conditions

We foresee that over time there is significant interaction between the constituents of the industry in terms of co-opetitive evolution; it is argued that as the surrounding “business environment” or “innovation system” shapes the enterprises, the enterprises also shape the surroundings gradually, and more importantly the enterprises and institutions also shape each other through communication, information and knowledge exchange and learning (Lamberg & Parvinen, 2003; Rogerson, 2011). Thus we foresee drivers that affect the JAP on three levels. First the work in

some of the actions potentially changes priority and feasibility of the other actions especially in the long run. Second, the usual development of the industry outside the JAP influences the competences of the enterprises, the direction of their search and priorities. Third, the gradual, or sometimes discontinuous, change in the wider business environment has an effect on the goals and priorities for the enterprises. This suggests two continuous processes that are needed for systematic update of the JAP:

- Monitoring the industry framework conditions and structure to evaluate if the current strategy and objectives are relevant
- Monitoring the progress of the JAP actions, their success and the relevance of on-going and scheduled actions for the industry

The prime concern for sustainability of the JAP beyond ECOWindS project is its relevance for the OWS industry together with partner and stakeholder commitment. Precursor for relevance is continuous monitoring and updates that keep the document a living commonly accepted statement of the industry. In the long run, updating the JAP relies on committed ownership of the JAP and a committed core group of stakeholders who have clear responsibilities for key activities relating to the JAP. Figure 6 proposes an organization for the monitoring and evaluation system.

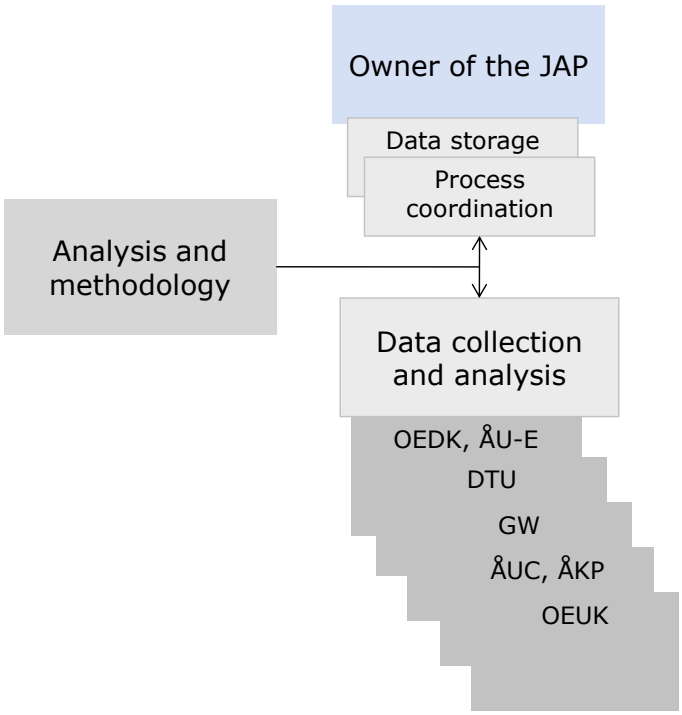

Figure 6: Organization of M&E (a proposal)

The appointment of a 'process owner' or coordinator for the JAP and the evaluation/adaptation process is an important precursor for sustainability of the JAP. The main task of the coordinator of the JAP is to monitor the OWS industry and launch an update of the JAP with the post-ECOWindS collaborators to keep the JAP up-to-date and relevant for the industry constituents, and to support international collaboration on OWS specific relevant RDI as directed by the JAP. The key responsibility of the coordinator of the JAP regarding the evaluation and update process is to take charge for monitoring as well as coordinating the process and follow up data gathering and recording, and trigger the analysis and update of the JAP at appropriate intervals.

During the ECOWindS project, the project coordinator has been responsible for orchestrating the overall actions around the JAP. Discussions to form a long term 'Post-ECOWindS collaboration' to oversee the implementation of the JAP after the ECOWindS project have been started during the JAP process. It is foreseen that this Post-ECOWindS collaboration will take the responsibility of coordinating the actions around the JAP and other ECOWindS deliverables. The organizational form of this consortium is not set and it does not have to be limited to present ECOWindS consortium.

The analysis and methodology partner in ECOWindS is WP4 leader, Technical University of Denmark (DTU). After ECOWindS the instance in charge of analysis may be a constellation of partners from a Post-ECOWindS collaboration or an outside contractor. All the partners are responsible for contributing to data collection and documentation of their work with the JAP. These include beside the mentioned partners Offshoreenergy.dk (OEDK), Germanwind GmbH, Orbis Energy (OEUK) which comprises Nautilus Associates (NA) and NWES Property Services, Ålborg University at Esbjerg (AAU-E), Ålesund University College (AUC) and Ålesund Technology Park (AKP). In the post-ECOWindS phase this constellation partners may be different.

A Method for Evaluating the JAP

This section outlines a methodology for evaluation of the JAP specifically within the ECOWindS runtime. The methodology is piloted during the first half of 2015 within the project. The methodology can be applied to continuous monitoring and evaluation of the JAP by the JAP owner with suitable level of detail.

Because of the complexity of the interaction between the intervention and its surrounding, and the time span for the first round of evaluation, it is not expected that a black box input/output assessment will answer all the relevant questions in a way that would support adaptation. Thus we propose theory-based evaluation approach which will paint a richer picture of the effect of the JAP and also enables answering questions related to how and why did something happen of did not.

The evaluation design conforms to a general pathway for foresight evaluation proposed by Sokolova and Makarova (Makarova & Sokolova, 2012; Sokolova & Makarova, 2013), from evaluation design through identifying evaluation criteria, to data collection and analysis, and finally, reporting.

Introduction to Evaluation and Associated Terminology

The dictionary definition for evaluation is; to evaluate means to "to determine the significance, worth, or condition of [something] usually by careful appraisal and study" (Merriam-Webster Contributors, 2013). The logic of evaluation is to indeed analyze, appraise and draw judgment on the success of an intervention, through systematic analysis of inputs, activities, outputs, outcomes and impacts of the intervention in in relation to its objectives. Evaluation is frequently attached to a set of practical objectives, such as impact to society or enterprises, and judgment is drawn against criteria of a corresponding practical orientation. (cf. Figure below)

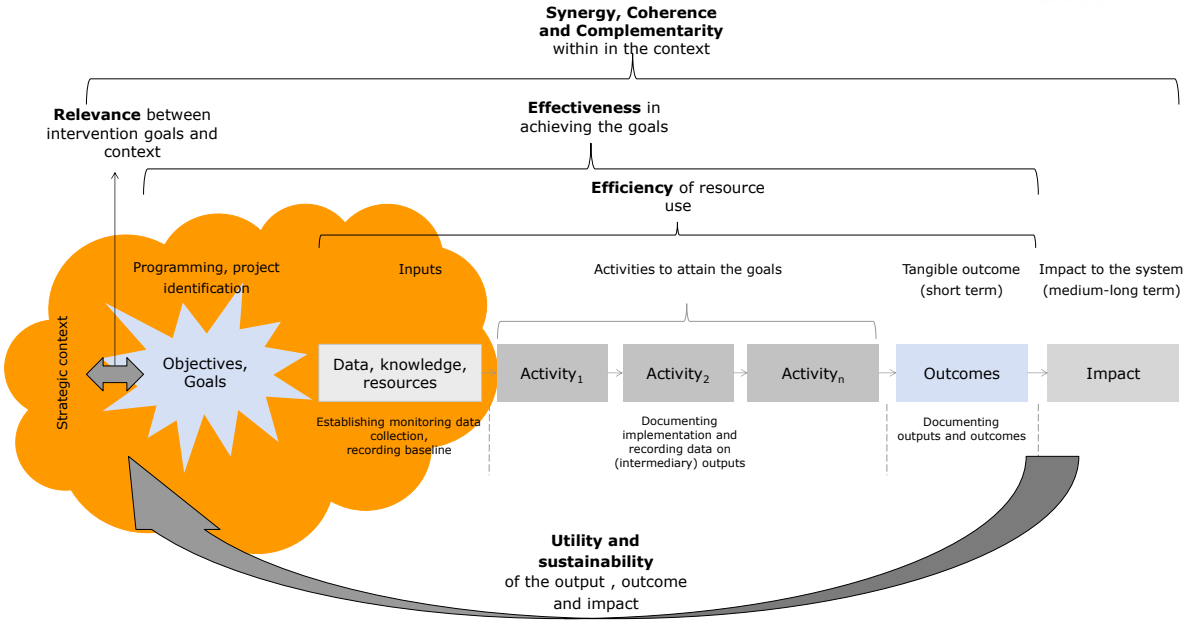

Figure 7: Illustration of the logic and terminology of evaluation

Within this general framework there are different schools of thought and emphases. One dimension or distinction is between summative and formative evaluation and impact assessment. Summative evaluation generally deals with efficiency and effectiveness of an intervention, often in descriptive terms. Formative evaluation is on the other hand explicitly concerned with providing suggestions for improving the performance of an intervention and collecting lessons learned. Generally evaluation answers an evaluation question of a set of questions related to the appropriateness, relevance, efficiency, effectiveness, additionality and impact of the object of evaluation. Table 3 elaborates what kinds of questions deal with the different aspects of evaluation.

Table 3: Aspects of evaluation and generic questions

Dimension/ Criteria	Type of question
Relevance	How relevant the objectives (and activities) were to the original needs, problems or issues
Effectiveness	How well the objectives (and intended impact) were achieved
Efficiency	Were the resources and inputs transformed to outputs efficiently, were the costs acceptable compared to the effect size
Utility	How well the original problems were solved by outputs, outcomes and impacts
Sustainability	How likely it is that the positive effects of the outputs, outcomes and impacts last after the intervention is terminated
Coherence	Is the intervention logic compatible with other interventions with same objectives; Are the actions appropriate for to solve the original problem
Complementarity	What other interventions contribute towards the same objectives
Output	What are the tangible direct outputs of the actions
Outcome	What are mid-term effects of the output in relation to the original need; how well they serve the need
Impact	What are long-term effects of the outputs in relation to the original need; how well they serve the need
(Behavioral) Additionality	What behavioral changes/learning were introduced in the activities

Impact assessment or impact evaluation refers specifically to, often quantitative, assessment of the attribution of the intervention to the observed outcome and impact. The specific aims of impact assessment are to establish causal attribution of the intervention. Attribution is the key difference between impact assessment and other evaluation, as attribution analysis implies that the analysis will establish a causal relationship between intervention and observed changes in the world beyond reasonable doubt, i.e. it specifically addresses what exact portion of the observed impact was *caused* specifically by the intervention, and what was baseline development of inference by other interventions and other noise. Regularly evaluation can only claim to establish contribution of the intervention to observed outcomes and impacts, i.e. evaluation can commonly report that the intervention has helped in achieving the outcomes and impacts, but it is not the sole cause and other factors are at play as well. (White, 2009)

Monitoring is an adjacent activity to evaluation. It entails recording, cataloging and storing the evidence relevant to evaluating the impact of the intervention. These data include frequently documentation of the activities, outputs and observed immediate outcomes. It may include also recording other interventions that address the same problem and population as well as changes in boundary conditions that are relevant to the impact.

Previous literature on assessing the impact of foresight provide insight to the observed and plausible impacts of foresight discussed above (Amanatidou & Guy, 2008; Johnston, 2012). Piirainen et al. (2012) have proposed an evaluation framework for futures studies, which focuses on the process, content and outputs as well as impacts of futures study or foresight and proposes

some general indicators for evaluation. Similar contribution in specific foresight context is made as an integrates framework for foresight evaluation (Makarova & Sokolova, 2012; Sokolova & Makarova, 2013). Georghiou and Keenan (2006) focus three dimensions which correspond roughly to efficiency, effectiveness, and utility. They emphasis learning the lessons from execution and continuous improvement beside other aspects of behavioral additionality, i.e. behavioral changes introduced by foresight intervention. They also remind that (national) foresight is only one input within any given national policy framework and drivers, which makes impact assessment particularly challenging, which suggests formative or summative evaluation, and putting more weight to evaluation of coherence and complementarity. Specific criteria, indicators, measures or metrics for foresight evaluation haven been proposed by Georghiou and Keenan (2006) Makarova and Sokolova (2012) and Johnston (2012)

Harper (2013) observes that foresight is predominately assessed from a project management perspective, by the effectiveness, by how well the project is delivered in terms of activities and deliverables/outputs agreed between principal/owner of the project and the agent/executor who implements the project. The rationale is of course the logic of public procurement and necessity to gain timely information about the project. However, the negative effect of this focus is that it sets incentives for both the principal and especially the agent that may turn the focus of foresight narrowly on project management and delivery of a predetermined set of activities, instead of maximizing the impact. This thinking is rooted in the concept of additionality, which means the contribution of a public intervention to producing something that would not be otherwise accomplished (Table 4).

Table 4: Concepts of additionality (Autio, Kanninen, and Gustafsson 2008; Clarysse, Wright, and Mustar 2009; through Viljamaa et al. 2013)

<table>
<tr><th>Level</th><th>Input</th><th>Activities</th><th>Output</th><th>Outcome and impact</th></tr>
<tr><td>1st order additionality</td><td colspan="2">Input additionality:
Leverage of public subsidy to increase private investment (as measured by private investment per public investment, or increase over baseline private investment)</td><td>Output additionality:
(Proportion of) Outputs that would not have been realized without subsidy</td><td rowspan="2">Outcome and impact additionality
(Indirect and direct) outcomes that would not have been achieved without the intervention/subsidy
Effect of the activities and outputs, that would not have been accomplished without the intervention/ subsidy</td></tr>
<tr><td>2nd order additionality</td><td></td><td colspan="2">Behavioral additionality:
Behavioral changes in organizations, routines and individuals as a result of exposure to the subsidized work
Risk, ambition, volume and speed of delivery compared to unsubsidized projects</td></tr>
</table>

The logic behind much of evaluation literature and practice in Europe is that publicly subsidized activities or interventions should not displace ‘the normal functioning of the markets’ and that subsidies are aimed to correct ‘market failures’ that arise from asymmetric information and perceived excessive risk (since at least Arrow 1962), and thus public subsidies should achieve something that would not have been attempted or achieved with private funding alone (Metcalfe, 2005). This effect is relatively easy to assess for simple funding interventions or subsidies. However, when we consider foresight, assessing the impact will become much more intricate and separating the additionality from the normal functioning of the systems is more uncertain as the intermediate effects are hard to measure accurately and the measurement of the impact within a reasonable time scale is problematic as well. In other words, paraphrasing Einstein, everything that

can be measured quantitatively does not necessarily matter in terms of evaluation; everything that matters cannot necessarily be measured (Miles, 2012).

Evaluation Questions and Criteria

The following evaluation matrix summarizes the evaluation design in terms of criteria, questions and criteria. The criteria include the ones described in the DoW. Keeping with the theory-based approach, we have proposed an ex-ante theory of change or impact logic for foresight (Appendix 1) which has informed the evaluation questions. The overall proposal is that following exposure to the social process of foresight and the outputs, the exposed individuals act within their personal conviction and self-efficacy and the institutional boundaries and constraints (organizational agendas, goals, resources and politics) to work towards the goals and actions proposed in the foresight process. Thus we should see outcomes including changes in strategy, new partnerships and RDI projects. Further moderators for this impact include perceptions of process quality and ensuing trust and commitment to results, which will be reflected in individual attitude.

In anticipation of the measurement and following the theory-based practices referred to above, we may separate three groups in terms of involvement and likely impact.

- The first tier comprise foresight participants, i.e. persons involved in the process first hand, including the project personnel and stakeholder participants and the so-called Regional Steering Groups, who are the ones who will likely demonstrate most behavioral additionality.
- The second tier of impact includes the cluster participants who are exposed to the outputs and thus are more likely to exhibit less behavioral additionality due to weaker nature of exposure.
- The 'control group' who are least exposed include the non-committed cluster members and non-members, who will view the ECOWindS outputs as just another strategy or agenda among others.

As a technical note relating to the following evaluation matrix, not all the indicators proposed in the project DoW were SMART[2], e.g. "transnational cooperation" and "new cooperation" do not specify what counts as cooperation. The relevant unit of analysis for ECOWindS and the success of the JAP are instances of RDI collaboration and subsequent innovations and their market acceptance, that are the materialization of the JAP success or failure. The 'collaboration instances' are defined below and in Appendix 2.

Further, the same indicator should not load to multiple criteria as it presents a double attribution problem, i.e. need to separate not only the impact of the intervention to an observed change in an indicator but also find out the relative importance of the these contributions (EuropeAid Co-operation Office, 2006; White & Phillips, 2012). Additionally, there is an element of circular reasoning in proposing to measure whether an intervention whose main goal is to put cluster organizations to work together by criteria "transnational cooperation between … OWS-RDCs" which are essentially the same organizations. Thus following table integrates the projects own evaluation questions and indicators, complementing them with others.

[2] SMART, or more broadly SMARTER, is an acronym that stands for Specifically operationalized; objectively Measurable; Ambitious and Actionable; Relevant, Results- oriented and Rewarding; Time-bound, Engaging and Recordable and variations thereof (See e.g. Wikipedia Contributors 2014)

Table 5: Evaluation matrix, including questions, criteria and thresholds for the JAP

Dimension/Criteria	Question	Indicators/Criteria	Thresholds	Methods and data sources
Effectiveness and Utility	Was international cooperation between clusters enhanced/increased?	New (informal) connections between cluster members	200	Survey for clusters
		New international RDI projects	5	Survey for clusters
		New international enterprises alliances		Survey for clusters
		New international joint ventures		Survey for clusters
		Perception of international cooperation		Survey for clusters
	Was regional cooperation enhanced?	New research, development and innovation projects including the regional authorities, research entities and local business		Survey for clusters
		New RDI projects		Survey for clusters
		New enterprise alliances		Survey for clusters
		New joint ventures		Survey for clusters
		Perception of regional cooperation		Survey for clusters
	Were regional links between industry, policy makers and research institutions improved?	New contacts between regional stakeholders	5	Survey for clusters
		Incorporation of the JAP conclusions in regional strategy		Survey for clusters, Document analysis
		Incorporation of the JAP conclusions in regional EURDF strategy		Survey for clusters, Document analysis
	Did the cluster become more international?	Share of exports of turnover before and after intervention	Ratio/increase	Survey for clusters Industry statistics
		Cluster regions' market share of world market before and after intervention		Survey for clusters Industry statistics
	Did the regional clusters become more visible internationally?	Perception of international visibility (cross check between clusters)		Survey for clusters Interviews within cluster organizations
Efficiency	Was the delivery of JAP efficient in terms of resources?	Resource use compared to similar projects		Benchmarking to other projects
Relevance	Was ECOWindS relevant to the industry?	Perception of relevance in the industry		Survey for clusters Interviews within cluster organizations
Coherence and Complementarity	How did ECOWindS complements other Offshore Wind strategies and projects?	Added value of ECOWindS to other similar projects		Benchmarking Survey to clusters
Sustainability	Commitment of stakeholders?	Perception of sustainability of JAP		Interviews within cluster organizations
	Systems that ensure sustainability?	Presence of systems to keep the JAP up to date		Interviews within cluster organizations
Additionality	Did participation in the process change attitudes?	Perceived attitude change		Interviews/survey to process participants Survey to clusters
	Behavioral beliefs during and after the process	Self-efficacy of participants Personal and organizational commitment to JAP		Interviews/survey to process participants Survey to clusters

In terms of indicators, the ones closest to the strategic objectives are the effectiveness and utility criteria, which should be adequately monitored. However, to separate contribution from attribution, the influence for the cooperation and other outcomes needs to be separated as far as possible to separate the net impact of the ECOWindS. This requires conscious evaluation of the impact logic as well, including consideration of alternative explanations and refining the impact logic based on data.

3. Evaluation Design

Evaluation Approach

Here we refer mainly to evaluation in the sense of theory-based evaluation, including the theory of change framework and realistic evaluation (Blamey & Mackenzie, 2007; Pawson & Tilley, 1997; Vogel, 2012). Evaluation of the impact of an intervention can be based on an ex post or ante intervention logic or theory of change, which is essentially a theory that predicts what will be the impact of an intervention on the socio economic system. Within this domain evaluation aims to falsify, or in practice more often corroborate, that theory. On the practical level, the following principles are prescribed for theory-based evaluation (White, 2009):

1. establishing a causal explanation and assumptions;
2. understanding the context
3. anticipation of heterogeneity and interaction with the context
4. rigorous use of factual and
5. counterfactual analysis
6. using mixed methods.

In the context of this evaluation we develop an intervention logic, or an utility theory of foresight, and use it as a starting point to direct the evaluation design. The details of this ex ante theory and its derivation are presented in Appendix 1. Evaluation here means collecting evidence about the additionality of foresight and separation of the effect of foresight from baseline development. The same data can be used to falsify or corroborate the theory proposed in this paper without a conflict of interest, as in principle evaluation of both interventions and theories require setting a null hypothesis that there is an effect, and then trying to falsify this.

While the size of the OWS industry (population, N) is large according to the ECOWindS regional mapping (up to a thousand enterprises per each of the four regions) the number of first tier process participants is limited, less than two dozen per region ($n<20x4$). As each region forms a subgroup, the treated sample size excludes most statistical testing or severely limits the significance of such testing as far as direct participants are concerned. Thus small-sample techniques for analyzing attribution are relevant for this evaluation (White & Phillips, 2012). The approaches relevant are contribution analysis (Mayne, 2001) and success case method (SCM) (Brinkerhoff, 2005).

Contribution analysis in sum is an approach that aims to constructing a contribution story based on evidence gathered on the intervention. The data collection is guided by an impact logic or theory of change, which is contrasted with the contribution story and developed long the evaluation (Mayne, 2001, 2008). The approach may resemble grounded theory research, where a causal explanation of the intervention and its effects are built on evidence of relationship between events found in the data. The levels of analysis associated with the contribution analysis:

1. Within cluster management organizations
2. Within Industry, plus and relation cluster management organization/ industry
3. Cross-cluster (also cooperation between cluster management organizations of different clusters)

The SCM in turn is an approach that relies on identifying successful individual cases where the intervention has had the expected impact and investigating the cases to uncover what are the causal factors that have lead up to the impact, including the intervention and other contextual factors. In addition to the successful 'best' cases, unsuccessful 'worst' cases can be sought out to compare effect of contextual factors in the impact of interventions. SCM has originally been used in evaluation of organizational interventions, e.g. staff training, and thus we consider it to be a useful approach to test organizational level impact and test alternative hypothesis and it thus aids constructing a strong theory of change (Coryn, Schroter, & Hanssen, 2009).

Case studies combine interviews, document analysis and other data where appropriate. Based on the theoretical discussion we derive an analysis framework for the cases, following the best practices (Eisenhardt & Graebner, 2007; Yin, 2003). Yin (2003) argues that the research design, based on the research problem is the fundamental base of the study which guides collecting and interpretation of evidence and provides a "logical model of proof that allows the researcher to draw inferences concerning causal relations among the variables under investigation". The model is elaborated below in table 8.

Table 6: Case study design for OWS collaboration and innovations

Design elements	**Questions**
RQs	What is the contribution of ECOWindS JAP to the collaboration, is there attribution? What are the factors leading up to the collaboration and successful delivery? What were the obstacles and enablers of collaboration?
Propositions	*P1: The most clear attribution effect of the JAP is found in process participants* *P1a: Attribution is stronger in new contacts and early-stage-partnerships* *P1b: Path dependency and previous contacts dominate RDI partnerships and joint ventures* *P1c: Some contribution to content of established partnerships may be found* *P2: Some contribution will be found from RDC stakeholders* *P3: the looser the coupling with the JAP process, the smaller the contribution of JAP*
Unit of analysis	Instances of RDI collaboration in OWS sector OWS innovations
Logical link between data and propositions	The cases provide insight to attribution or contribution of ECOWindS JAP. The cases may render insight to factors that contribute to OWS innovations The cases may provide insight to the impact logic of foresight in case there is contribution
Criteria for interpreting findings	If effect of JAP is not recognized, there is no contribution or attribution Attribution is found if informants recognize that idea for collaboration was found in JAP document or process

These approaches complement each other in this evaluation. Contribution analysis establishes an overall logic for intervention and enables focusing on the most fruitful activities. The SCM will give additional insight to the circumstances where successful collaboration was achieved, which enables developing the JAP and its implementation activities.

Field Methods and Analysis

The field methods for data collection were outlined briefly in the evaluation matrix. The 'standard' field methods for evaluation of foresight are interviews, surveys and statistics (Sokolova & Makarova, 2013). In this evaluation, interviews and surveys are used in conjunction with the success case method. Together these methods lead up to insights why the intervention works and enable approaching attribution in analysis at least for the participants of the process. This analysis also leads to further insights for updating and adapting the JAP which will be discussed below separately.

The basis for identifying case studies for the SCM is identification and recording of collaborations. The collaboration instances include the spectrum from workshops, networking events, and working groups to collaborative RDI projects, alliances and innovations. These instances need to be identified to choose success and failure cases that enable establishing attribution of ECOWindS JAP and, to establish the causes for success and failure and insight to the causes and effects that made the collaboration successful. These case studies establish the attribution or contribution of the intervention, and the mediating factors that facilitate or impair the impact of the intervention. The following table suggests what information is relevant for each instance.

Table 7: Documentation or collaboration instances

Dimensions	Questions
Unit of analysis	Instances of RDI collaboration in OWS sector, and OWS innovations
Types	From the project objectives: • New contacts between enterprises • New partner negotiations • New working groups and other (loose) collaborations • New RDI projects, including private RDI, collaborative RDI between enterprises and public-private partnerships • New joint ventures and cross-ownership etc. arrangements
What to document	• Partners • Contact person • Start time and duration • Objectives • Relationship with ECOWindS

In connection to the monitoring and update mission of the Joint Action Plan the ECOWindS partners should also follow industry news and publications to identify RDI projects and other collaborations that correspond to the JAP and contact the project to inquire about possible connection to ECOWindS and JAP. This approach offers an excellent opportunity for establishing attribution as long as the number of events is small enough to handle. The documentation of these cases or instances needs to be done with the same template (see Appendix 2-3).

Another basic method is interviews. Technically, in this context, they would be semi-structured interviews. This means that the interviewer has a set of themes or open-ended question for the interview that probe the issue. The interview is conducted by asking the questions or introducing the themes one by one, and leading the discussion to the direction of the themes gently when discussion veers away. The interviews are generally noted and/or recorded for further analysis. Interviews as proposed above, would be used to provide background and context to the general perceptions within the industry and also in connection with the SCM to investigate successful and unsuccessful use of the JAP, and thus should utilize purposive sampling (Palys, 2008) to focus on persons who have a good overview of the industry. The following figure illustrates the sampling, the aim is to cover immediate process participants and broadening outwards. At the same time, a survey is directed to the clusters to collect an overview of the JAP recognition and effect. Overall these data are used to describe a number of success cases and formulate a contribution story.

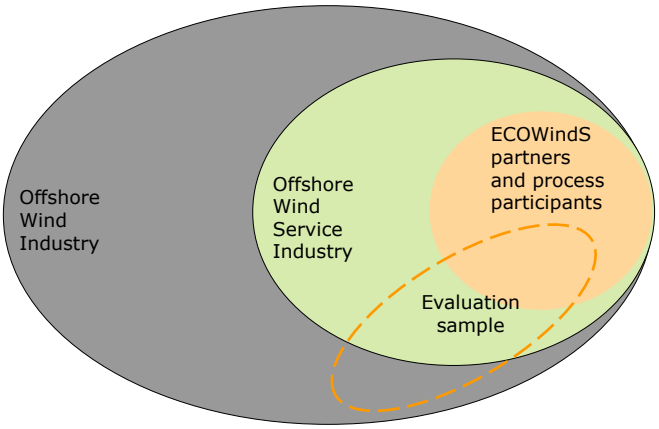

Figure 8: Sampling logic

The qualitative data including interviews and documents will be analyzed and coded through content analysis, searching for patterns that relate to the evaluation questions. Content analysis is a rule-guided technique for condensing, classifying and analyzing textual data (Schilling, 2006). It involves either searching predefined text instances based on existing categories or searching textual patterns and creating emergent categories (Stemler, 2001). In this case categories are created based on the evaluation matrix.

Ideally the impact of JAP would be confirmed with industry statistics and/or self-reported figures of number of collaboration instances before and after the ECOWindS JAP process. However, due to the lead time to launch of new innovations, market shares or other financial statistics will likely not show any effect during the evaluation period. However, it is useful and informative for the cluster organizations to establish a monitoring database on industry collaborations and innovations for further reference to enable following the impact and to inform cluster management. The most cost-efficient method for collecting comprehensive data on progress of the cluster is a web based survey for the OWS clusters through the cluster organizations i.e. ECOWindS partners. A survey can provide a cross sectional ‘snap-shot’ view to the industry at a given point of time, and let draw distinction between the different groups including the process participants, JAP users and others. Additionally a survey may identify cases to be examined closer. The sample should be a (pseudo) random sample of the industry, or even a blanket sample of all relevant enterprises. In the latter case, very low response rate (as low as 5-10%) is expected. It is also expected that data should be tested for non-response, selection and late-comer biases. Another consideration for sampling is securing representative coverage of likely JAP users including process participants and equally representative sample of non-committed ‘control group’ respondents.

However, as a survey is a snapshot, it should be repeated periodically (once a year or more seldom) to identify trends or development over time. Preferable method would be a panel survey, which targets the same respondents every round. Targeting the same respondents provides more consistent assessment of the issues and lowers sample bias, as taking a different sample each time will potentially significantly alter the results for each round.

The main methods for survey analysis will be basic statistics in terms of quantitative analysis. The exact tests depend on final data quality and availability. Statistical testing can entail testing differences in measured outcome between groups and co-variation between different variables through e.g. correlation and regression analysis.

The overall challenge in analysis is to first of all trace contribution and possible attribution of the ECOWindS project in the OW/-S industry, and further separate the impact of the JAP (WP4) from the impact of other ECOWindS activities. It is expected to some extent that as WP3 and WP6 have parallel and to some extent similar deliverables that will likely be communicated before and in parallel to the JAP within the industry, the attribution of the JAP specifically may be hard to trace.

Data Collection and Procedures

The data collection at its simplest is interleaved with the work of the cluster organizations and is a daily or weekly activity. It includes registering new collaboration instances that are relevant to the JAP, at least on the level of start date and main partners/contact person (c.f. Appendix 2). The sources for this data are industry news, informal discussion with colleagues, co-workers and clients/industry representatives. This work supports later identification of successful and unsuccessful partnerships and estimation of ECOWindS attribution effect. Additionally it supports recognition of industry networks which is useful for the cluster organizations.

The evaluation intensifies periodically. The first round of assessment is expected roughly one year from launch of JAP in quarter 1-2 2015. The evaluation draws together the interim data collection, identifies interesting cases and collects evidence through survey, supplementary interviews and case studies to build a contribution story, estimate the initial impact or outcome of the JAP process and extract lessons from case studies on collaboration instances. At the time of the evaluation, the documented collaborations are drawn together, analyzed, and interesting cases are booked for additional interviews. The aim is to have overall 2-3 cases per region, or until saturation of themes is reached (Eisenhardt, 1989). At the same time, a survey is directed to the clusters to collect an overview of the JAP recognition and effect. Overall these data are used to describe a number of success cases and formulate a contribution story.

Thus we propose that the first round of evaluation focuses more on the process and content of the JAP, and given the relatively short timeframe less on the underlying assumptions and circumstances around the JAP. On the further rounds, we propose that the evaluation shifts from the process to content and goals and circumstances to ensure that the JAP is up to data and represents on one hand the capabilities and SWOTs of the industry and on the other also reflects the collective goals of the industry.

The following chart (Figure 8) establishes a preliminary timeline for evaluation of the JAP for the first round of evaluation. The data used for follow up and evaluation comprise RDI collaboration instances as outlined in table 8 above a survey for the OWS industry constituents in the four regions as well as supplementary semi-structured interviews and relevant documents including industry news and enterprise documents such as are available.

The main body of data, the documentation of RDI collaboration needs to be done by the ECOWindS partners as a part of day to day activities, whenever interacting with cluster members. There is a synergy between outlining new RDI collaborations and WP7 communication activities, which are routinely gathered during the project.

The survey(-s) and supplementing interviews are done at intervals. Within the ECOWindS project the evaluation of the JAP and a pilot of this protocol for evaluating and updating the JAP will be done during the runtime of the ECOWindS project during 2015. We foresee that a follow up of JAP progress and relevance once a year is sufficient to fuel a rolling update for the JAP in terms of the actions as well as the goals.

Activities	2014								2015									
	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10
Evaluation of JAP																		
Finalization of study design and instruments																		
JAP is released																		
Recording collaboration and innovation incidents																		
Choosing critical cases																		
Interview contacts																		
Interviews and document collection																		
Survey design, piloting and implementation																		
Data analysis																		
Evaluation conclusions and drawing lessons																		
Update of JAP																		
Documentation of continuous feedback from stakeholders																		
Collecting and documenting experiences from implementation (WP5&6) and other project development																		
Assessing the feedback, additional data collection and recommendations of evaluation																		
JAP update																		

Figure 9: Timeline of the evaluation

The responsibilities in performing the evaluation are as noted in the evaluation process and organization in sub section “A system for adapting the JAP”. The JAP owner will coordinate the process. DTU is responsible for the evaluation methodology, instruments and protocols for data collection together with the other partners. The on-going collection or documentation of RDI collaboration is the main responsibility of the partners within their own regions. DTU is in charge of technical implementation of the evaluation survey while the partners are responsible for identifying respondents, providing contacts and distributing the survey. Again for the supplementary interviews, each partner is responsible for identifying possible interviewees based on the documentation of the collaboration instances. The interviews are conducted jointly by DTU and all of the partners with the same question template, recorded and/or noted down for further analysis. The following table details responsibilities of partners

Table 8: responsibilities of the partners during evaluation and adaptation of the JAP

	Preparation and initiation	Initiation	Data collection	Analysis	Reporting	Update of the JAP
JAP owner	Determine the need for evaluation and update cycle	Identification of target group for the survey and interviews Identification of people to interview	Administer interviews as agreed	Analysis of (non-english) interview data Feedback on the analysis	Feedback	Determine the need of updates for JAP
Evaluator	Prepare evaluation framework instruments and protocols for data collection and analysis	Planning of sampling	Implement survey Administer interviews as agreed	Coordinate the analysis Draw overall conclusions	Coordinate reporting	Determine the need of updates for JAP Adaptation of the JAP Actions and Implementation Guidelines
Other partners	Following industry conditions, monitoring Feedback on the evaluation	Identification of target group for the survey and interviews Identification of people to interview	Administer interviews as agreed	Analysis of (non-english) interview data Feedback on the analysis	Feedback	Determine the need of updates for JAP
All partners	Following industry conditions and JAP assumptions, documenting changes that (may) have bearing on the JAP Documentation of new collaboration instances					

Analysis and Update of the JAP

The evaluation, as per the evaluation questions has bearing on among other things the relevance of the JAP, its impact to the industry and coherence and complementarity with other initiatives. The analysis combines the collected evidence and compiles and a ‘contribution story’ (Mayne, 2012) that describes what impact the JAP achieved during the first period and why. The contribution story builds on the theory of change or impact logic and gathers evidence of the activities outputs and further on the outcome and impact. In this case, very concisely, the outputs are the deliverables of the ECOWindS project, particularly the JAP and Implementation Guidelines (Deliverables 4.1 and 4.2), and the expected outcome is increased collaborative RDI leading to more effective and efficient OWS operations and overall lower LCoE in offshore wind industry.

The data is analyzed to form a bottom-up contribution story that challenges the original impact logic. This analysis enables updating the impact logic and identifying the general factors that have contributed to success or failure. This enables critical examination of the general assumptions of the JAP and update to the impact logic and content of the JAP. The case studies further lend an insight to the boundary conditions of the industry and expectations for collaboration. The cases identify factors that contributed to success or failure of attempted actions, which enables designing action to support those conditions and contribute to replicating success stories.

In anticipation of the evaluation results, we outline some scenarios for adapting the JAP. In interpreting the results, three things should be separated, 1) the impact of the JAP and ECOWindS, 2) the content of the JAP and 3) the effect of framework conditions. The reason is that the impact is a product of involvement in the process, stakeholder engagement and use of the JAP, as well as the actual content of JAP. We expect that stakeholder communication plays a role together with the other factors outlined in the impact logic. The following schema (Figure 9) separates the dimensions of engagement and reactions to the evaluation findings. Impact of the JAP is measured in short by its recognition in the stakeholder group but more importantly in the number of collaboration initiatives that would not have been started without the JAP process and/or document (attribution) or that have been influenced, reinforced, speeded up, prioritized or otherwise affected by the JAP process or document (contribution).

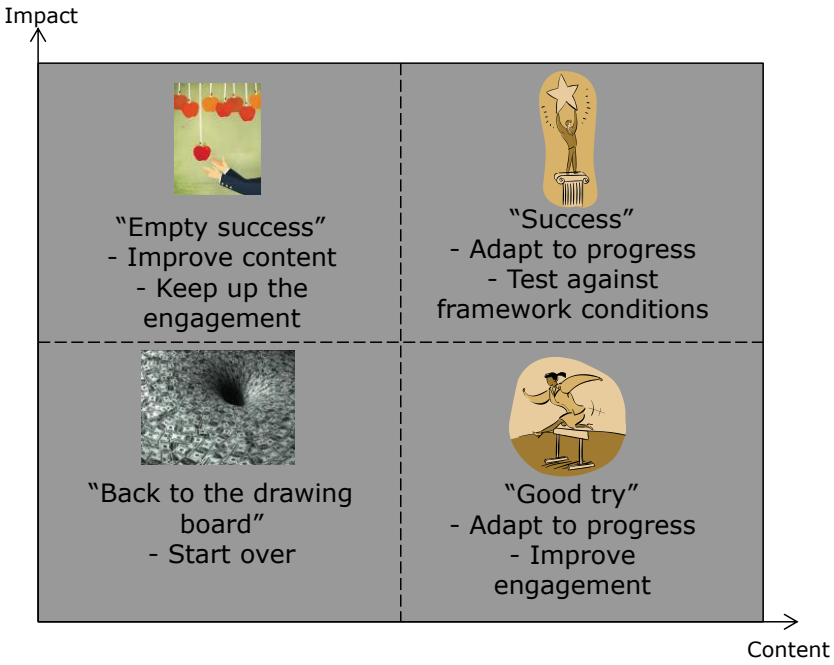

Figure 10: A Scheme of interpreting the evaluation findings

Another aspect then is interplay between the framework conditions of the industry and the JAP. The JAP relies to a degree on the assumption that the industry structure, capabilities and business environment stay stable to a degree. However, it is expected that some actions may change, become redundant or unrealistic when the industry move forwards and the condition change as a matter of course.

These findings inform the implementation guidelines for the JAP in terms of priority of the actions and give rise to adaptation to the actions and/or their timing. The adjustments include the path, timing and also the actions. Additional monitoring is needed to check whether the assumptions underlying the JAP still hold. Due to normal development or sudden events related to e.g. energy policy and regulation over the life time of the JAP, the industry boundary conditions and

assumption behind business models may become challenged. This situation may become apparent either in evaluation of JAP or during the normal course of business in the cluster through the monitoring activities. In the case of such an eventuality, there may be a call to update the SWOT analyses, and at least the Strategic Orientation, i.e. strategic goals, as well as the JAP together with or consulting the stakeholders. This larger update also calls for examination of the impact logic, but not necessarily the monitoring and evaluation method.

4. Conclusion

This report has laid out the method for evaluating and updating the Joint Action Plan in the context of the ECOWindS project. The key for the long term success and sustainability of the JAP is to establish ownership and set up a system for assessing the relevance of the JAP for the industry. This Evaluation and Adaptation Report sets up a framework for systematic monitoring of the JAP which enables following the progress systematically and aids in adapting the JAP to the inevitable changes in the industry.

The presented method is based on a solid foundation in evaluation literature, yet it is intended to be easy enough for use by practitioners. The method presented herein will be piloted and refined within the ECOWindS project during 2015 and field methods, protocols and interpretation guidelines for the data will be refined based on those experiences. This piloting will give grounds for transferring the system to practice beyond ECOWindS.

5. References

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Alkemade, F., Kleinschmidt, C., & Hekkert, M. (2007). Analysing emerging innovation systems: a functions approach to foresight. *International Journal of Foresight and Innovation Policy*, *3*(2), 139–168.

Amanatidou, E., & Guy, K. (2008). Interpreting foresight process impacts: Steps towards the development of a framework conceptualising the dynamics of “foresight systems.” *Technological Forecasting and Social Change*, *75*(4), 539–557.

Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: a meta-analytic review. *The British Journal of Social Psychology*, *40*(4), 471–499. doi:10.1348/014466601164939

Arrow, K. J. (1962). Economic Welfare and the Allocation of Resources for Invention. In Universities-National Bureau (Ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors* (pp. 609–626). Cambridge, MA: National Bureau of Economic Research.

Autio, E., Kanninen, S., & Gustafsson, R. (2008). First- and second-order additionality and learning outcomes in collaborative R&D programs. *Research Policy*, *37*(1), 59–76.

Bacharach, S. B. (1989). Organizational theories: Some criteria for evaluation. *Academy of Management Review*, *14*(4), 496–515.

Belis-Bergouignan, M.-C., Lung, Y., & Héraud, J.-A. (2001). Public foresight exercises at an intermediate level: the French national programs and the experience of Bordeaux. *International Journal of Technology Management*, *21*(7/8), 726–738.

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research Policy*, *37*(3), 407–429. doi:10.1016/j.respol.2007.12.003

Blamey, A., & Mackenzie, M. (2007). Theories of Change and Realistic Evaluation: Peas in a Pod or Apples and Oranges? *Evaluation*, *13*(4), 439–455. doi:10.1177/1356389007082129

Briggs, R. O., & Murphy, J. D. (2011). Discovering and Evaluating Collaboration Engineering Opportunities: An Interview Protocol Based on the Value Frequency Model. *Group Decision and Negotiation*, *20*(3), 315–346. doi:10.1007/s10726-009-9158-x

Brinkerhoff, R. O. (2005). The Success Case Method: A Strategic Evaluation Approach to Increasing the Value and Effect of Training. *Advances in Developing Human Resources*, *7*(1), 86–101. doi:10.1177/1523422304272172

Cagnin, C., Amanatidou, E., & Keenan, M. (2012). Orienting European innovation systems towards grand challenges and the roles that FTA can play. *Science and Public Policy*, *39*(2), 140–152. doi:10.1093/scipol/scs014

Calof, J., Miller, R., & Jackson, M. (2012). Towards impactful foresight: viewpoints from foresight consultants and academics. *Foresight*, *14*(1), 82–97. doi:10.1108/14636681211210387

Calof, J., & Smith, J. E. (2010). Critical success factors for government-led foresight. *Science and Public Policy*, *37*(1), 31–40. doi:10.3152/030234210X484784

Chang, M. K. (1998). Predicting Unethical Behavior : A Comparison of the Theory of Reasoned Action and the Theory of Planned Behavior, 1825–1834.

Clark, C. (1957). *The Conditions of Economic Progress*. *The conditions of economic progress* (p. 584). New York, NY: Macmillan.

Clarysse, B., Wright, M., & Mustar, P. (2009). Behavioural additionality of R&D subsidies: A learning perspective. *Research Policy*, *38*(10), 1517–1533.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*(1), 128–152.

Coryn, C. L. S., Schroter, D. C., & Hanssen, C. E. (2009). Adding a Time-Series Design Element to the Success Case Method to Improve Methodological Rigor: An Application for Nonprofit Program Evaluation. *American Journal of Evaluation*, *30*(1), 80–92. doi:10.1177/1098214008326557

Delgado, M., Porter, M. E., & Stern, S. (2012). Clusters, Convergence, and Economic performance. *NBER Working Paper*. Cambridge, MA.

Dosi, G. (1988). Sources, Procedures, and Microeconomic Effects of Innovation. *Journal of Economic Literature*, *26*(3), 1120–1171.

Dubin, R. (1969). *Theory Building*. New York, NY: The Free Press.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532–550. doi:10.5465/AMR.1989.4308385

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory Building from Cases: Opportunities and Challenges. (A. M. Huberman & M. B. Miles, Eds.)*Academy of Management Journal*, *50*(1), 25–32. doi:10.2307/20159839

EuropeAid Co-operation Office. (2006). Cause-and-effect analysis. *Evaluation Methods*. Retrieved January 31, 2014, from http://ec.europa.eu/europeaid/evaluation/methodology/methods/mth_att_en.htm

Fidler, D. (2011). Foresight defined as a component of Strategic Management. *Futures*, *43*(5), 540–544. doi:10.1016/j.futures.2011.02.005

Fisher, A. G. B. (1939). Production, Primary, Secondary and Tertiary. *Economic Record*, *15*(1), 24–38. doi:10.1111/j.1475-4932.1939.tb01015.x

Georghiou, L. (1998). Issues in the Evaluation of Innovation and Technology Policy. *Evaluation*, *4*(1), 37–51. doi:10.1177/13563899822208374

Georghiou, Luke, & Keenan, M. (2006). Evaluation of national foresight activities: Assessing rationale, process and impact. *Technological Forecasting and Social Change*, *73*(7), 761–777. doi:10.1016/j.techfore.2005.08.003

Gregor, S., & Jones, D. (2007). The Anatomy of a Design Theory. *Journal of the Association for Information Systems*, *8*(5 (May 2007)), 312–336.

Harper, J. C. (2013). Implementing Foresight Study Results in Policy Action and Measures: EU Experiences. In D. Meissner, L. Gokhberg, & A. Sokolov (Eds.), *Science, Technology and Innovation Policy for the Future: Potentials and Limits of Foresight Studies* (pp. 219–230). Berlin, Heidelberg: Springer. doi:10.1007/978-3-642-31827-6

Harper, J. C., & Georghiou, L. (2005). The targeted and unforeseen impacts of foresight on innovation policy: the eFORESEE Malta case study. *International Journal of Foresight and Innovation Policy*, *2*(1), 84. doi:10.1504/IJFIP.2005.007597

Havas, A., Schartinger, D., & Weber, M. (2010). The impact of foresight on innovation policy-making: recent experiences and future perspectives. *Research Evaluation*, *19*(2), 91–104. doi:10.3152/095820210X510133

Heger, T., & Boman, M. (2013). Value Creation from Networked Foresighting in the EIT ICT Labs. In *The Proceedings of the XXIV ISPIM Conference*. Helsinki, FI.

Johnston, R. (2012). Developing the capacity to assess the impact of foresight. *Foresight*, *14*(1), 56–68. doi:10.1108/14636681211210369

Keenan, M., & Popper, R. (2008). Comparing foresight “style” in six world regions. *foresight*, *10*(6), 16–38. doi:10.1108/14636680810918568

Kortelainen, S., & Lättilä, L. (2009). Modeling Strategic Technology Management with a Hybrid Model. In A. Ford, D. N. Ford, & E. G. Anderson (Eds.), *Proceedings of the 27th International Conference of the System Dynamics Society*. Albuquerque, NM: System Dynamics Society.

Lamberg, J.-A., & Parvinen, P. (2003). The River Metaphor for Strategic Management. *European Management Journal*, *21*(5), 549–557. doi:10.1016/S0263-2373(03)00104-X

Loveridge, D. (2001). Foresight - seven paradoxes. *International Journal of Technology Management*, *21*(7/8), 781. doi:10.1504/IJTM.2001.002950

Makarova, E. A., & Sokolova, A. V. (2012). Foresight Evaluation: Lessons from Project Management. *Basic Research Program Working Papers*. Moscow, RU: National Research University Higher School of Economics.

Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, *31*(2), 247–264.

Martin, B. R. (1995). Foresight in science and technology. *Technology Analysis & Strategic Management*, *7*(2), 139–168. doi:10.1080/09537329508524202

Martin, B. R., & Johnston, R. (1999). Technology Foresight for Wiring Up the National Innovation System. *Technological Forecasting and Social Change*, *60*(1), 37–54. doi:10.1016/S0040-1625(98)00022-5

Mayne, J. (2001). Addressing Attribution Through Contribution Analysis: Using Performance Measures Sensibly. *The Canadian Journal of Program Evaluation*, *16*(1), 1–24.

Mayne, J. (2008). Contribution analysis: An approach to exploring cause and effect. Rome, IT.

Mayne, J. (2012). Contribution analysis: Coming of age? *Evaluation*, *18*(3), 270–280. doi:10.1177/1356389012451663

Merriam-Webster Contributors. (2013). Evaluate. *Merriam-Webster Online Dictionary*. Retrieved September 03, 2013, from http://www.merriam-webster.com/dictionary/evaluate

Metcalfe, J. S. (2005). Innovation Policy in a Knowledge-Based Economy. In P. Llerena & M. Matt (Eds.), *Innovation Policy in a Knowledge-Based Economy* (pp. 47–74). Berlin Heidelberg: Springer-Verlag. doi:10.1007/b137610

Miles, I. (2010). The development of technology foresight: A review. *Technological Forecasting and Social Change*, *77*(9), 1448–1456. doi:10.1016/j.techfore.2010.07.016

Miles, I. (2012). Dynamic foresight evaluation. *foresight*, *14*(1), 69–81. doi:10.1108/14636681211210378

Miles, I., Harper, J. C., Georghiou, L., Keenan, M., & Popper, R. (2008). The Many Faces of Foresight. In *The Handbook of Technology Foresight: Concepts and Practice*. Edward Elgar.

Moen, R. D., & Norman, C. L. (2010). Circling Back: Clearing up myths about the Deming cycle and seeing how it keeps evolving. *Quality Progress*, *43*(11/November), 22–28.

Montaño, D. E., & Kasprzyk, D. (2008). Reasoned Action, Planned Behavior, and the Integrated Behavioral Model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health Behavior and Health Education: Theory, Research and Practice* (pp. 67–96). San Fransisco, CA: Josey Bass.

Nadkarni, S., & Narayanan, V. K. (2007). Strategic schemas, strategic flexibility, and firm performance: the moderating role of industry clockspeed. *Strategic Management Journal*, *28*(3), 243–270. doi:10.1002/smj.576

Nalebuff, B. J., & Brandenburger, A. M. (1997). Co-opetition: Competitive and cooperative business strategies for the digital economy. *Strategy & Leadership*, *25*(6), 28–35. doi:10.1108/eb054655

Nelson, R. R. (Ed.). (1993). *National Innovation Systems : A Comparative Analysis*. New York, NY: Oxford University Press.

OECD. (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition* (3rd ed., p. 163). Paris, FR: OECD.

Palys, T. (2008). Purposive Sampling. In L. M. Given (Ed.), *The Sage Encyclopedia of Qualitative Research Methods* (Vol. 2, pp. 697–698). Thousand Oaks, CA: Sage Publications.

Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, *13*(6), 343–373. doi:10.1016/0048-7333(84)90018-0

Pawson, R., & Tilley, N. (1997). *Realistic Evaluation* (p. 235). Thousand Oaks, CA: Sage Publications.

Piirainen, K. A. (2014). Monitoring and Evaluating Investments. In K. Halme, I. Lindy, K. A. Piirainen, V. Salminen, & J. White (Eds.), *Finland as a Knowledge Economy 2.0: Lessons on Policies and Governance* (pp. 117–134). Washington D.C.: The World Bank. doi:10.1596/978-1-4648-0194-5

Piirainen, K. A., Gonzalez, R. A., & Bragge, J. (2012). A systemic evaluation framework for futures research. *Futures*, *44*(5), 464–474. doi:10.1016/j.futures.2012.03.008

Piirainen, K., Koria, M., Ngoc, C. T., Wangwe, S., Wennberg, M., & Lemola, T. (2013). *An Analysis of the Drivers for Emerging Sectoral Innovation Systems in Developing Economies: Cases Tanzania and Vietnam* (p. 149). Helsinki, FI: Aalto University.

Popper, K. R. (1963). Science as Falsification. In *Conjectures and Refutations* (pp. 33–39). London, UK: Routledge and Kegan Paul.

Popper, R. (2008). How are foresight methods selected? *foresight*, *10*(6), 62–89. doi:10.1108/14636680810918586

Porter, M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, *14*(1), 15–34. doi:10.1177/089124240001400105

Rogerson, A. Rivers and puddles: metaphors for explaining the need for continuous change and development in modern organisations. , Sydney Business School - Papers (2011).

Rohrbeck, R. (2012). Exploring value creation from corporate-foresight activities. *Futures*, *44*, 440–452. doi:10.1016/j.futures.2012.03.006

Salo, A. A. (2001). Incentives in technology foresight. *International Journal of Technology Management*, *21*(7/8), 694–710. doi:10.1504/IJTM.2001.002944

Sardar, Z. (2010). The Namesake: Futures; futures studies; futurology; futuristic; foresight—What's in a name? *Futures*, *42*(3), 177–184. doi:10.1016/j.futures.2009.11.001

Saritas, O., Pace, L. A., & Stalpers, S. I. P. (2013). Stakeholder participation and dialogue in foresight. In K. Borch, S. M. Dingli, & M. Sørgaard Jørgensen (Eds.), *Participation and Interaction in Foresight: Dialogue, Dissemination and Visions* (pp. 35–69). Cheltenham, UK: Edward Elgar.

Schilling, J. (2006). On the Pragmatics of Qualitative Assessment. *European Journal of Psychological Assessment*, *22*(1), 28–37. doi:10.1027/1015-5759.22.1.28

scientific theory. (2013). *Encyclopædia Britannica Online*. Retrieved September 02, 2013, from http://www.britannica.com.globalproxy.cvt.dk/EBchecked/topic/528971/scientific-theory

Sokolova, A., & Makarova, E. (2013). Integrated Framework for Evaluation of National Foresight Studies. In D. Meissner, L. Gokhberg, & A. Sokolov (Eds.), *Science, Technology and Innovation Policy for the Future: Potentials and Limits of Foresight Studies* (pp. 11–30). Berlin, Heidelberg: Springer Berlin Heidelberg. doi:10.1007/978-3-642-31827-6

Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research & Evaluation*, *7*(17).

Sutton, R. I., & Staw, B. M. (1995). What Theory is Not. *Administrative Science Quarterly*, *40*(3), 371–384.

Viljamaa, K., Piirainen, K., Kotiranta, A., Karhunen, H., & Huovari, J. (2013). *Impact of Tekes Activities on Productivity and Renewal* (p. 83). Helsinki, FI: Finnish Funding Agency for Technology and Innovation - TEKES.

Vogel, I. (2012). *ESPA guide to working with Theory of Change for research projects* (p. 38). Edinburgh, UK.

Voros, J. (2003). A generic foresight process framework. *foresight*, *5*(3), 10–21. doi:10.1108/14636680310698379

Whetten, D. A. (1989). What Constitutes a Theoretical Contribution? *The Academy of Management Review*, *14*(4), 490–495. doi:10.2307/258554

White, H. (2009). Theory-Based Impact Evaluation: Principles and Practice. New Delhi, IN.

White, H., & Phillips, D. (2012). Addressing attribution of cause and effect in small n impact evaluations: towards an integrated framework. New Delhi, IN.

Wikipedia Contributors. (2014). SMART Criteria. *Wikipedia - The Free Encyclopedia*. The Wikimedia Foundation. Retrieved January 30, 2014, from http://en.wikipedia.org/w/index.php?title=SMART_criteria&oldid=592801250

Yin, R. K. (2003). *Case Sudy Research* (3rd ed.). Thousand Oaks: Sage Publications.

Yuan, B. J. C., Hsieh, C.-H., & Chang, C.-C. (2010). National technology foresight research: a literature review from 1984 to 2005. *International Journal of Foresight and Innovation Policy*, *6*(1/2/3), 5–35. doi:10.1504/IJFIP.2010.032663

APPENDIX 1: A Theory of Change for Foresight

What constitutes a theory

Starting from the general definition, a theory is a "systematic ideational structure of broad scope, conceived by the human imagination, that encompasses a family of empirical (experiential) laws regarding regularities existing in objects and events, both observed and posited. A scientific theory is a structure suggested by these laws and is devised to explain them in a scientifically rational manner." ("scientific theory," 2013).

According to Popper a theory in essence establishes a causal link between constructs, predicting the interdependent behavior, i.e. how the system behaves if the theory holds, and further forbids certain behaviors what should not happen if the theory holds. That is to say that a theory should be both positive and exclusive, i.e. it should be explicit about which phenomena it explains and which it does not, and not be irrefutable by observed phenomena. (K. R. Popper, 1963). Thus a theory explains phenomena in terms of causal link between real and artificial constructs through a set of laws or principles for interaction between constructs. To this end, a theory needs to comprise definition of the relevant constructs, the principles of interaction, predictions about expected behavior of the system and associated testable propositions or hypotheses (Dubin, 1969; Gregor & Jones, 2007).

Following the more general thought, the discussion on management research, a field adjacent to foresight, has had a discussion on what constitutes a theory. Whetten builds on Dubin in posing four questions that need to be answered (Bacharach, 1989; Dubin, 1969; Whetten, 1989):

- *What* constructs and factors are relevant to explanation of the phenomenon of interest?
- *How* are the constructs related; what are relationships?
- *Why* the constructs are expected to behave as posited by the theory; what are the underlying dynamics of the interaction that manifest in the expected behavior?
- *Who, where, when*; what are the boundaries of the expected interaction; what is expected to happen between the constructs, where and when? What is not supposed to happen? Where the theory is applicable, what are the values and other assumptions it relies on that limit applicability?

Sutton and Staw (1995) clarify the matter further by observing what is commonly mistaken for a (complete) theory. Their list includes important parts of a formalized theory, underlining that while a theory has many components or facets, the heart is a causal explanation to the phenomena of interest:

- *References are not theory*: Summarizing the existing body of literature without explaining how the literature forms a body of principles that explain the phenomena of interest is not a (contribution to) theory
- *Data are not theory*: Data describe what has been observed, theory explains why the observations are such as they are
- *List of variables or constructs are not theory*: Definition of constructs and/or associated variables is a necessary condition for (testing) a theory, but not sufficient alone.
- *Hypotheses are not theory*: Just as constructs and variables, hypotheses or predictions are a part of a theory, but not the thing itself.

- *Diagrams are not theory*: A diagram can be helpful in illustrating causal connections between constructs, but it is not a theory in itself without explanation of why the constructs are connected.

Domain and constructs – What and How

Foresight

The roots of foresight as a practice and research discipline are counted by Miles (2010). Compared to futures studies, foresight is a relatively young concept, with its roots policy making and public or private planning, particularly in the domain of research, development and innovation under the heading 'technology foresight'. However, in recent research and practice, the domain, application, approach, methods and use of terms frequently overlap with futures studies or futures research (R. Popper, 2008; Sardar, 2010). As discussed above, we tend not to enter into the discussion of definition any further than is necessary for us to establish the boundaries of theorizing. Thus we assume the position that the defining factor is that futures studies or research are scientifically motivated knowledge creating activities and foresight is practically motivated.

We refer to the definition established above, and continue, that the qualitative difference between foresight and (other) futures studies or research is that foresight is a purposeful process of developing knowledge about the future of a given unit of analysis or a system of actors, which is aimed at action in the form of public or private policy making, strategizing and planning, and that foresight is frequently a participatory, involved and collaborative process (Miles, Harper, Georghiou, Keenan, & Popper, 2008).

Voros (2003) has modeled a generic foresight process which captures the basic structure of foresight as commonly practiced. It is notable that the process includes a strategizing phase which implies that foresight should be attached to action. The process is commonly organized as prescribed by the generic guidelines and whichever methodology (Keenan & Popper, 2008; R. Popper, 2008) is seen as fitting for the scope and mission of the foresight.

In a typical foresight process, there is a client or sponsor who in a sense is the process owner and user of the results. Depending on arrangements, the owner either organizes the process internally or sources outside experts, typically foresight consultants and/or researchers as well as process consultants, to execute the process, who are the main actors. Depending on the details of the process and method, there are a variety of other participants, including domain experts, policy makers, industry representatives who participate in the process of knowledge creation and are expected to commit to the proposed actions.

These first to groups have also been called 'inner actors', whereas depending on the subject area and mission, there may be a host of stakeholders, including 'concerned citizen', lobbies, NGOs, associations and other special interest groups, who interact with the foresight formally within the process or informally through various interfaces, who are also called 'outer actors'. (Keenan & Popper, 2008; Saritas, Pace, & Stalpers, 2013; Yuan, Hsieh, & Chang, 2010) However, in large scale participative public foresight projects the border of participants and stakeholders is difficult to draw exactly, as e.g. UK Foresight Programme involved approximately ten thousand people in the 1990s (Salo, 2001) and recent Finnish National Foresight involved altogether hundreds of people through an open Delphi survey, ongoing web dialogue and different workshops (Piirainen and Halme, 2013).

Sectors, industries and innovation systems

The words sector, industry and branch are used often interchangeably. However the first two have a different meaning, as starting from the three-sector hypothesis (Clark, 1957; Fisher, 1939) an economy can be first divided to sectors from primary (extraction of raw materials and basic

processing) to tertiary (services) or quarternary (research and development) according to the extent they add value. A sector in this sense is composed of different industries. An industry, sector or branch is simply a goods or services producing segment of the economy, comprising a group of enterprises in a co-opetitive[3] relationship which perform similar production and service activities in essence serving the same customer needs, e.g. oil industry, mining industry steel industry, automotive industry, banking industry. Out of these examples, oil and mining would be in the primary sector, steel borderline secondary and banking tertiary. To add to complexity clusters are specific, traditionally geographically concentrated, groups of enterprises (not legal enterprise groups by ownership) that have tight relationship and unusual or above average productivity compared to industry average (e.g. Delgado, Porter, & Stern, 2012; Porter, 2000).

However, more recent authors seem inclined to use the word sector as a synonym for industry, e.g. Malerba (2002) writes about 'sectoral systems of innovation and production', where sector clearly denotes an industry. It seem that as services, the tertiary sector in the classical economic terminology, have gained importance in economy and the apparently terms 'services industry' or 'health care industry' are seen as contradiction in terms. Thus, despite the risk of confusion, we use industry and sector interchangeably to be consistent with contemporary literature.

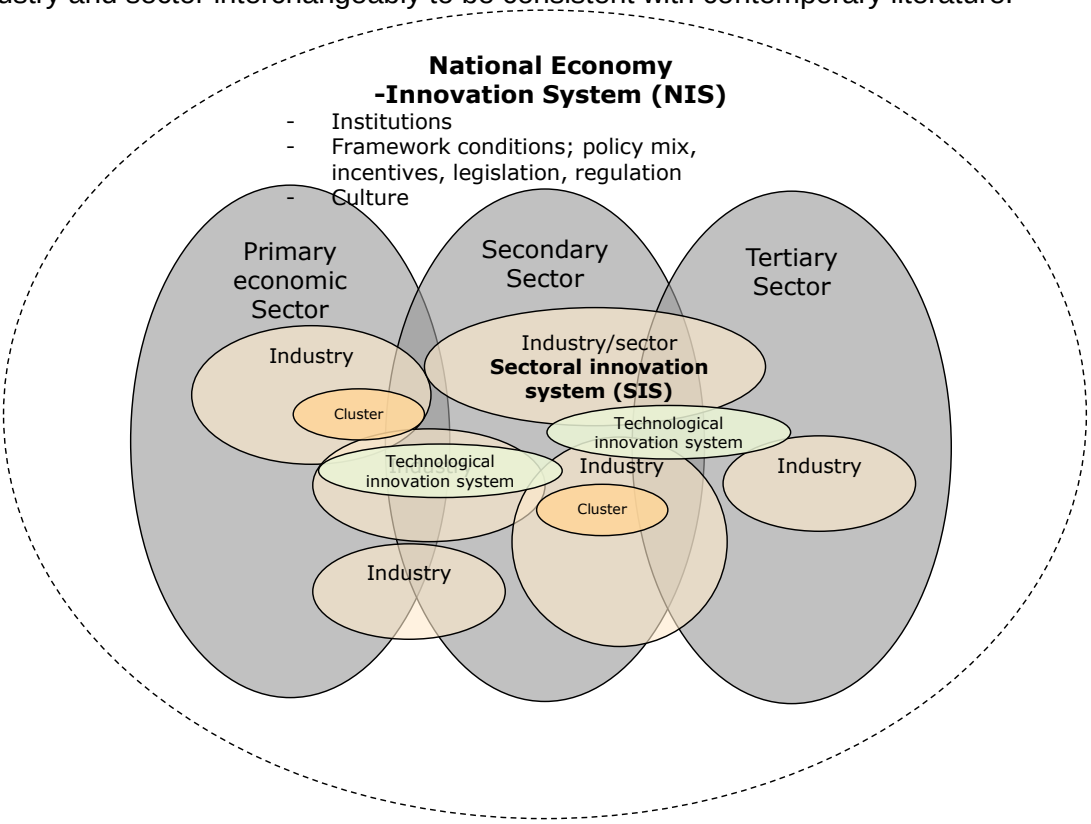

Figure 11: Illustration of the relationships between relevant terms

National innovation systems (NIS) are often defined in quite broad terms as "the set of institutions whose interactions determine the innovative performance of ... national firms" (Nelson, 1993, p. 4). The OECD (2005, p. 34) conceptualizes a (national) innovation system as a bundle the economic

[3] Co-opetitive: a portmanteau of the words competitive and cooperative, coined by Nalebuff and Brandenburger (1997), implies that relations between enterprises are not, nor need to be, straightforwardly head-on competitive. Rather, in reality competitors in the same industry/market can collaborate on different levels in order to enlarge the market, rather than just try to undercut each other to gain a larger share.

actors, that is enterprises; education and research system; infrastructure and institutional framework that sets legal and regulatory framework and enables communication; the market demand for products and services; and innovation policies set forth to support RDI activities. The behavior of the system arises as these actors work within boundaries set by the framework conditions, infrastructure and cultures (Nelson, 1993).

Accordingly NIS are studied and measured as a whole bundle of institutions, organizations and their linkages that make up the nations research, development and innovation system and its governance. An innovation systems approach emphasizes interactions between institutions and organizations in the private and public sectors (companies, research organizations, intermediaries and individuals) that contribute to the development, application, commercialization and diffusion of new technologies, processes and ways or organizing. As with innovation studies in a wider way, innovation systems also involve social and cultural systems in which technology is applied.

While (the definitions of) these systems clearly overlap, sectoral innovation systems (SIS) are defined on closer terms with the industry. “A sectoral system of innovation and production is a set of ... products for specific uses and the set of agents carrying out market and non-market interactions for the creation, production and sale of those products. A sectoral system has a knowledge base, technologies, inputs and an existing, emergent and potential demand. The agents composing the sectoral system are organizations and individuals ... Agents ... interact through processes of communication, exchange, co-operation, competition and command, and their interactions are shaped by institutions (rules and regulations).” (Malerba, 2002, p. 250). Thus, differing from the lenses of National innovation systems, the attention turns more toward the individual industrial organization, as the systemic behavior of sectoral innovation system is created foremost through the interplay of the firms and research organizations, working together or against each other within the framework conditions set by national and regional innovation systems.

The rationale for choosing the industrial sector as a level of analysis can be motivated both academically and practically. The most prominent argument for focusing on the sectoral level of innovation systems is that innovation dynamics differ significantly across sectors (Dosi, 1988). Innovation dynamics differ across industries because: (i) they dependent on different knowledge bases, and the technological opportunities differ across knowledge bases as a consequence of existing (national) strongholds and firm capabilities, and of types of knowledge (learning opportunities); (ii) technological and innovation competences, embodied in people and firms, are unequally distributed across sectors as a consequence of specialization of industrial structure and of education system (learning capabilities); (iii) the quality and volume of demand for output differs across industries which results in diverse demand-pull effects (Dosi, 1988).

Moreover, institutions relating to patents, appropriability conditions, competition and market structure are also likely to differ. These differences on sector level have to some extent been mapped by Pavitt (1984), and Nelson (1993) shows how innovation dynamics differ across countries (partly as result of diverse industry structures). These insights suggest that an industrial sector is internally relatively homogenous, allowing to analyze it as a single unit, whereas a national economy, or national innovation system, comprises multiple sectors/industries which have a different clock speed (Nadkarni & Narayanan, 2007), different institutions to some degree, different knowledge bases knowledge bases and thus paths of development, require different capabilities and thus provide a heterogeneous unit to analyze. The practical motivation for focusing on sectors in foresight is parallel to the theoretical rationale, as sectors may have their own institutions, knowledge brokers and exiting networks that facilitate the foresight process and implementation.

Expected impact of foresight - Who, Where, When

As a starting point to theorizing about foresight, we may visit the foregone experience, especially findings about the benefits of foresight. Our starting point is the literature review conducted by (Yuan et al., 2010) on national technology foresight, followed by literature search with keywords benefits or impacts of foresight, with coding the findings until saturation is reached. The results are presented in Table 9. If we attempt to formalize these relationships, what is suggested by the literature corresponds to the '5 Cs' of foresight originally proposed by Martin (1995):

1) the facilitated social process, which may be further supported by expert input which may or may not be futures studies, enables the participants to
    a. analyze the present developments and
    b. articulate their views on the future.
2) This thought process combined with argumentation, discussion and negotiation between the process participants and stakeholders enables mutual learning about participants' own views and objectives in relation to others' ('social learning' aspect).
3) This results in changes in mental models of the participants, resulting in perception of 'peripheral vision', and by extension also behavioral changes.
4) The output of this process is a, more or less, jointly constructed statement about future priorities, actions, goals and/or visions, which leads to action as
    a. the collaborative process builds commitment to the outputs
    b. and between the stakeholders,
    c. facilitating taking action,
    d. resulting in novel initiatives.
5) The impact is then 'innovation',
    a. goal congruence or strategic alignment and
    b. pooling of resources to area/projects deemed important through individual projects as well as new networks/partnerships; 'wiring up the innovation system' or 'structuring' efforts

The difference between (public) policy foresight and private or corporate foresight, seems to be level of analysis to some extent and scope of participation, but we argue that based on the literature their expected impact is similar and interrelated and thus we may consider them both in this paper.

One finding is, to use Harper & Georghiou's (2005) words, it is almost a truism that foresight has the benefits of facilitating success of national innovation systems through strategic discourse. It is notable that, in some support to reasoning on the nature of knowledge about the future, generally the impact of the process i.e. behavioral additionality of foresight is seen as large if not greater than the outputs (Saritas et al., 2013). In fact, it is suggested that foresight should not be judged by the accuracy or volume of its outputs, but rather by its behavioral influence (Salo, 2001). However, it seems that at least in the foresight community, the claims are not strongly connected to existing theory or substantiated by empirical inquiry. Partly due to the fact that the relationships are complex and the effects emerge conceivably a relatively long time after the formal ending of foresight (in the order of 1-3 years in the case of policy changes or even longer in the case of new industrial RDI initiatives) and in subtle ways, while evaluations are commonly executed shortly after the intervention (typically within a year after a sponsored foresight project has handed out the results).

Table 9: Benefits of foresight

Level of analysis	Process benefit/behavioral additionality	Output/outcome and impact
National innovation system/ economy	- Foresight within RDI funding programs build up capabilities for strategic flexibility and enable steering the RDI efforts during the program (Yuan et al., 2010) - Foresight on systems level enables more informed STI/RDI priorities (Amanatidou & Guy, 2008) - Allows the policy makers and RDI actors to work together in ways that are effective, credible, accountable and transparent; supports innovative policy making (Amanatidou & Guy, 2008; Harper, 2013; Yuan et al., 2010) - Facilitates policy implementation by supporting networking between stakeholders (Havas, Schartinger, & Weber, 2010) - Enables structural changes in innovation system through learning (Yuan et al., 2010) - 'Societal learning' builds relationships between science, engineer, politics, and other societal areas (Yuan et al., 2010); foresight has an important 'structuring' and capacity building effect on innovation systems (Cagnin, Amanatidou, & Keenan, 2012) - Foresight supports networking between actors and sectors (Harper & Georghiou, 2005)	- National foresight enables building up a sustainable innovation system and national strategy (in emerging economies) (Yuan et al., 2010) - Creates visions of future and other tangible outputs (Amanatidou & Guy, 2008) - Supports sustainable/continuous economic development (Yuan et al., 2010) - Increases realization of RDI projects (Yuan et al., 2010) - Supports priorization between RDI objectives and effective resource allocation through 'strategic interaction' (Yuan et al., 2010) - Broadens policy perspectives and options (Harper, 2013) - "Long-term impacts relate to re-alignment of the system, including the introduction of a disruption factor, inducing a major change in mindset, policy approach or new strategic direction" (Harper, 2013, p. 222) - Strategic alignment between national objectives and enterprise strategies (Yuan et al., 2010)
Regional (innovation systems)	- Public foresight is a process of communication, network building and collective learning (Belis-Bergouignan, Lung, & Héraud, 2001; Yuan et al., 2010); "a shared understanding of current problems, goals and development options can be expected to emerge" (Havas et al., 2010) - Engagement of SMEs, financial services, intermediaries and education institutes can create local-level innovation (Yuan et al., 2010)	
Industry/ sector/ cluster	- Supports network development (social networking and capital) and 'strategic' discourse; supports partnering and partner selection (formal networking) (Heger & Boman, 2013; Yuan et al., 2010) - Supports mutual learning, 'societal learning' and technology transfer (Yuan et al., 2010); 'wiring up the national innovation system' (Martin & Johnston, 1999) - "a shared understanding of current problems, goals and development options can be expected to emerge" (Havas et al., 2010) - Supports priorization between RDI objectives and effective resource allocation through 'strategic interaction' (Yuan et al., 2010)	

Level of analysis	Process benefit/behavioral additionality	Output/outcome and impact
Individual organization/ enterprise	- Interaction between stakeholders in networked foresight enables changes in the cognitive processes, values and routines (Saritas et al., 2013) - Monitoring future to inform planning; monitor internal and external changes and new needs, develop 'peripheral vision' or early warning and ability to cope with problems better (Fidler, 2011; Heger & Boman, 2013; Rohrbeck, 2012) - Initiate or facilitate strategic discussion or planning (Heger & Boman, 2013) - Develop shared understanding over objectives, goals, issues; develop visions (Heger & Boman, 2013; Rohrbeck, 2012) - Creates interest to current issues; promotes active participation (in general public) (Amanatidou & Guy, 2008) - increases 'social/relational capital', enables new actor combination/networks (Amanatidou & Guy, 2008)	

Interplay of constructs - *Why*

To develop an explanation, we have two distinct but related phenomena to try and explain. One is the social process and commitment to the planned action, and another is how commitment to the results will manifest as the impacts. In fact, based on the review presented above, we argue that impact of foresight is a social phenomenon that emerges due to the behavioral additionality of the process and not (entirely) a function of factual/substantial validity of foresight outputs. If we reformulate the logic, impact of foresight can be conceptualized as willingness to change existing behavioral patterns or adopt new behaviors. This changed behavior in turn will have an impact on the path of the economy.

We can approach this explanation on different levels of analysis, which imply different units as well. Firstly, we may look at the process and behavioral additionality or the outcome and impact, taking the process as more or less a black box. Or alternatively we may try to bridge these levels. Second, we may focus on the inter-organizational level, which can be conceptualized as a (sectoral) innovation system level and the macro level phenomena, on organizational level where the unit is aggregate organizational behavior, or on individual, micro, level where the unit comprises individuals who represent their organizations in the foresight process. Figure 11 below decomposes the proposed impacts of foresight discussed above in terms of the possible levels of analysis.

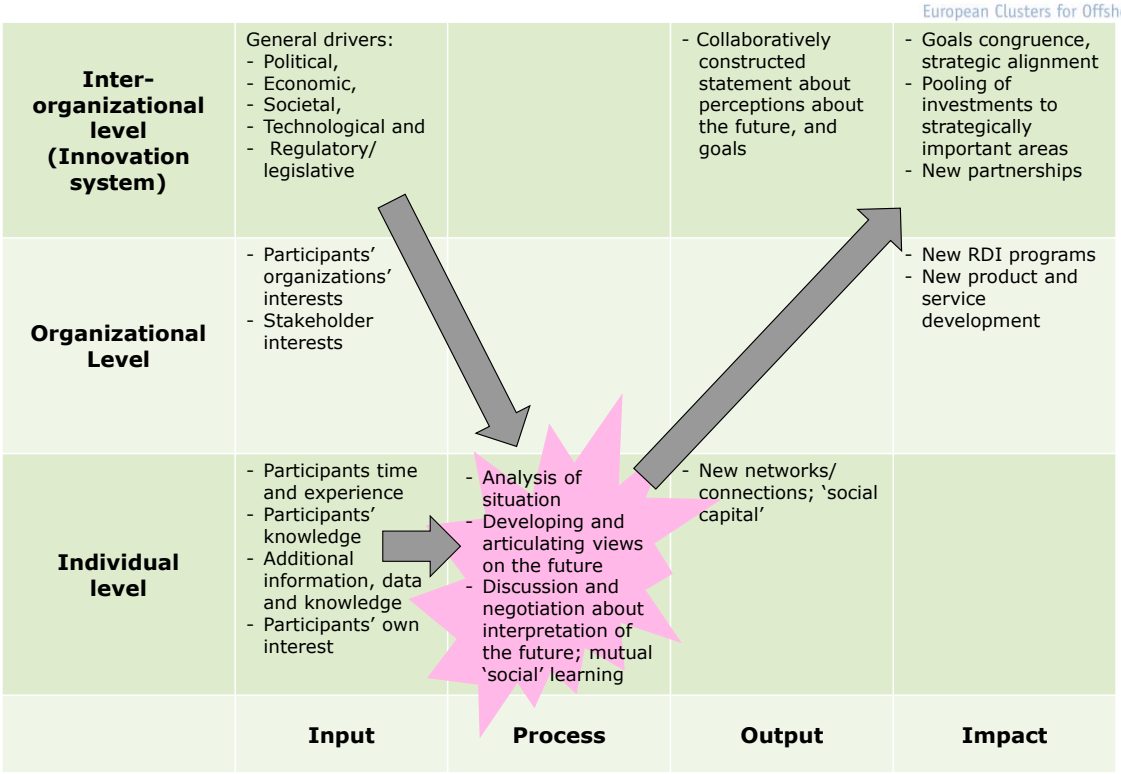

Figure 12: Impact of foresight decomposed to different levels of analysis

Base on this decomposition, we propose that an explanation of observed or proposed foresight impact has to integrate the levels of analysis, as we see that much of the impacts are observable on macro or meso levels, while the behavioral changes happen on the level of individuals. The key in explaining the impact seems to be individual willingness to act on the foresight (see point 4), as the preceding antecedents are more related to change of attitudes and knowledge. However, it must be recognized that the connection between output of foresight and its impact is subject to be moderated by organizational politics especially in the case of process participants, as the person who participated in the foresight cannot in most cases implement the ideas alone, and thus a new negotiation process will initiate within the constituents of the foresight on the actual course of action. Another perspective for stakeholders and sponsors is looking at foresight as a service (Miles, 2012), which however leads to a similar end result, where satisfaction with the results and organizational politics moderate the impact of foresight.

Thus we propose that behavioral science may contribute a theoretical basis for explaining behavior/action in terms of attitudes. One of the best known model for this is the theory of planned behavior (TPB) (Ajzen, 1991; Montaño & Kasprzyk, 2008), which has been employed to explain and predict behavior in a variety of fields from consumer behavior to business ethics and health issues (Armitage & Conner, 2001; Chang, 1998; Montaño & Kasprzyk, 2008). The figure below presents the causal model for TPB. The antecedents for behavior are individual beliefs concerning social norms and acceptability of behavior (Normative Beliefs), beliefs about the behavior itself (Behavioral Beliefs), and beliefs about outside control for behavior (Control Beliefs). These antecedents will influence individual attitude towards action, individual subjective norms that control behavior and Personal Control Belief (PBC), which affect the intention towards a certain patterns of behavior, which in turn will affect likelihood to actually perform it. PBC is perhaps the most opaque of the terms, however it can be defined as perceived ease or difficulty of performing the behavior (Armitage & Conner, 2001). PBC is sometimes replaced or complemented with self-efficacy, which can be defined simply as ability (Ajzen, 1991) or as confidence in one's ability to

perform the behavior. (Ajzen, 1991; Armitage & Conner, 2001) In short, the theory predicts that people will be positively inclined towards behavior more likely if they have a positive attitude towards it, it does not break their norms and it is perceived achievable, and if they are positively inclined and again perceive it achievable they will be more likely to perform the behavior. The TPB is a well-researched and validated theory that on average explains observation quite well. (Armitage & Conner, 2001)

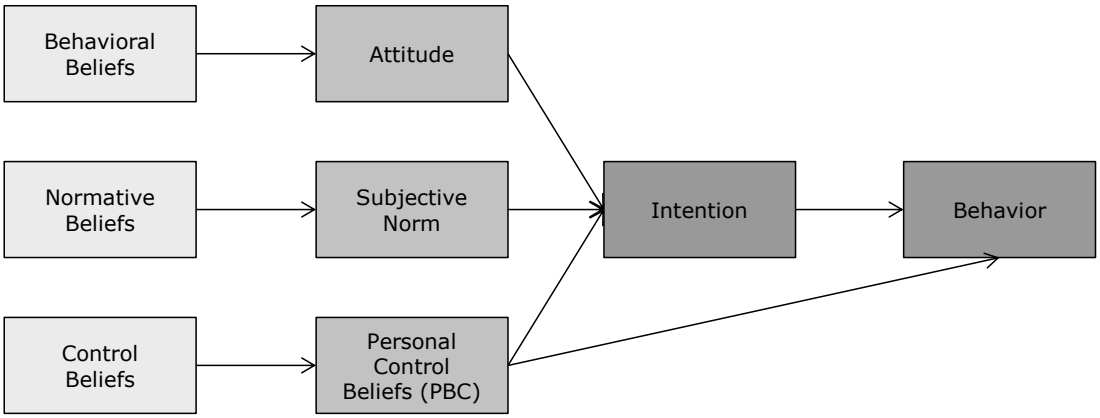

Figure 13: Constructs and causal links in TPB (Armitage & Conner, 2001)

The relevance to foresight is that the TPB suggests that foresight process may have its impact either through impact to attitude, norms of self-efficacy, as we may assume that skills and especially norms are not changeable in the course of a relatively short project. However, foresight may have an impact to PBC or self-efficacy, if it successfully draws a path from present predicament to the future. This proposition has possible implication also for organization of foresight, as the immediate implication is that people predisposed favorably to foresight and action based on it and congruence between participants' norms predicts higher likelihood of action. This in turn implies one of two things, either selecting a homogenous and positively motivated group or building the process purposefully to build these.

Another, more straightforward, model for explanation built on TPB is the Value Frequency Model for change (Briggs & Murphy, 2011), which has been developed to explain willingness to change work practices. The constructs are similar, but the explanation starts more straightforwardly from the perceived magnitude of net value from the change and perceived frequency of value, i.e. how often the net value increment can be extracted by changing practices, which are positively associated with willingness to change. The relationship is modified by certainty of perception, i.e. certainty of getting that value and perceived net value for transition, that is, additional value that can be gained during the process of transition. To some extent the models are analogous even though the constructs differ. Especially the constructs of perceived value and value frequency and certainty, which are associated with the risk and reward of the undertaking, can be seen in close association with the attitude and motivation. In terms of foresight process, exposure is another interesting construct, as the main proposal above can be interpreted that 'exposure' to others is one of the key mechanisms behind impact of foresight.

Altogether, we propose based on this discussion that a foresight process impact on the individual level is contingent on predisposition, process' impact on attitude and PBC or self-efficacy. The participants then take the output of foresight to their organization and act upon it based on the perceived value or behavior and PBC. The impact of this behavioral change will then be contingent on organizational politics, path dependency and resources (Cohen & Levinthal, 1990; Kortelainen

& Lättilä, 2009) and even further by inter-organizational dynamics, i.e. competition, market response and framework conditions, which brings us to the dynamics of innovation systems.

Bergek et al. (2008) have proposed a functional or process oriented approach to analysis of innovation systems. The core of the argument is that innovation systems have key functions, or processes, that actually make it a system, rather than an arbitrary collection of organizations. The functions are originally discussed in the context of technological innovation systems, but the functions have been applied to sectoral systems as well (K. Piirainen et al., 2013). According to the analysis there are six functions that make an innovation system a system (Table 10).

Table 10: Functions of innovation systems (Bergek et al., 2008; K. Piirainen et al., 2013)

Functions	Elaboration
Market formation	Creating a market or a learning space; identification of customer segments pilot installations and reference cases, educating potential customers; development of (industry) standards,
Entrepreneurial experimentation	Experimentation with new technologies, products, services and business models
Influence in the direction of search	Dynamic co-opetitive search for new markets, technologies and business models; possibly also negotiation and/or intervention; priorization between technologies and business models
Knowledge development and diffusion	Fundamental and applied research and development of new technologies, diffusion of technology and knowledge
Resource mobilization	Gathering capabilities and intangible/human, financial and tangible resources; ensuring relevant training to support availability of resources
Legitimation	Creating a ‘space’ for the new innovation system within the institutional framework; securing social acceptance/license

The underlying theme is that, within a given national and international framework, innovation systems compete with each other; when they start to emerge, they need to create a space where they can exist, often by capturing markets and resources from existing innovation systems, and when they mature, they need to keep that space through negotiation and evolution and fend off other incumbents and new systems.

Although Bergek et al. (2008) present the functions primarily as a descriptive framework for analysis, as have others (e.g. Alkemade, Kleinschmidt, & Hekkert, 2007), the framework also includes identification of policy instruments to foster growth, which implies that predictions can be derived from the framework. In fact previous literature has already taken this step and used the functions as a model for sectoral development (K. Piirainen et al., 2013). The prediction from the literature is that if the functions exist and the processes work, they enable growth and evolution of an innovation system by feeding the individual actors and (co-opetitive) networking between them. Further prediction is that there are inducement and blocking mechanisms that may inhibit or foster development of the innovation system.

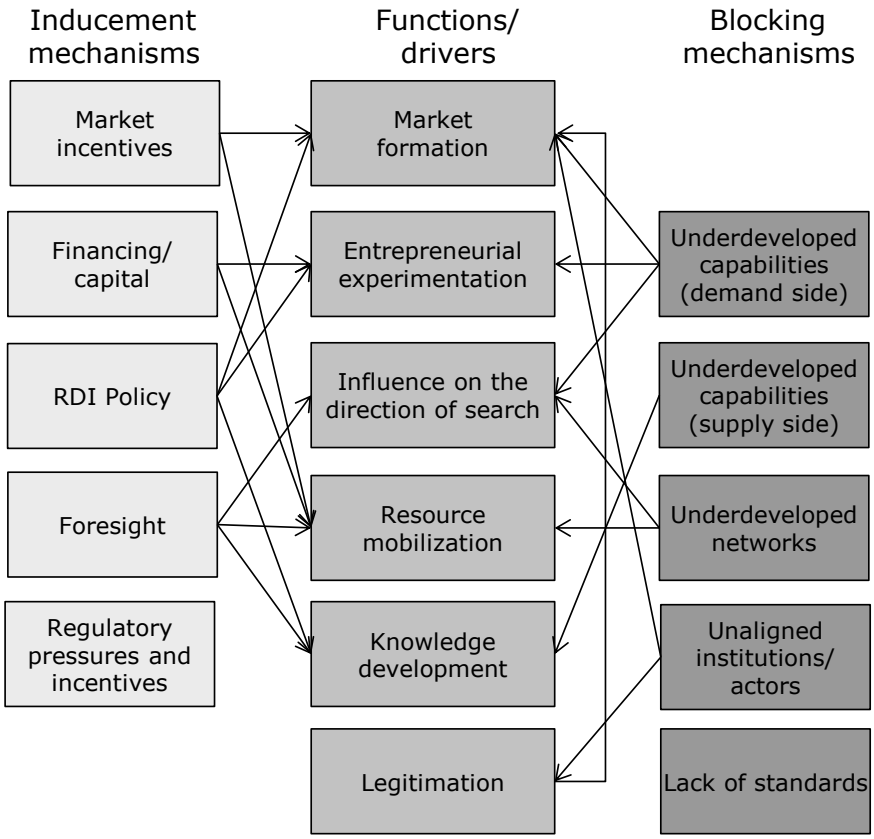

Figure 14: Functions/drivers for innovation systems (adapted from Alkemade et al., 2007; Bergek et al., 2008; K. Piirainen et al., 2013)

The relevance of these drivers to foresight are linked to the ability of a foresight process act as a networking platform and a process to influence the individual actors in terms of attitudes, perceptions and behavior regarding e.g. 'direction of search' for technological solutions as well as direction of RDI activities (knowledge development) and entrepreneurial experimentation. For example Alkemade et al. (2007) argue implicitly that foresight, particularly a 'functions approach', can play a role in formation of an innovation system, by revealing the state and dynamics of the system and thus enabling necessary actions.

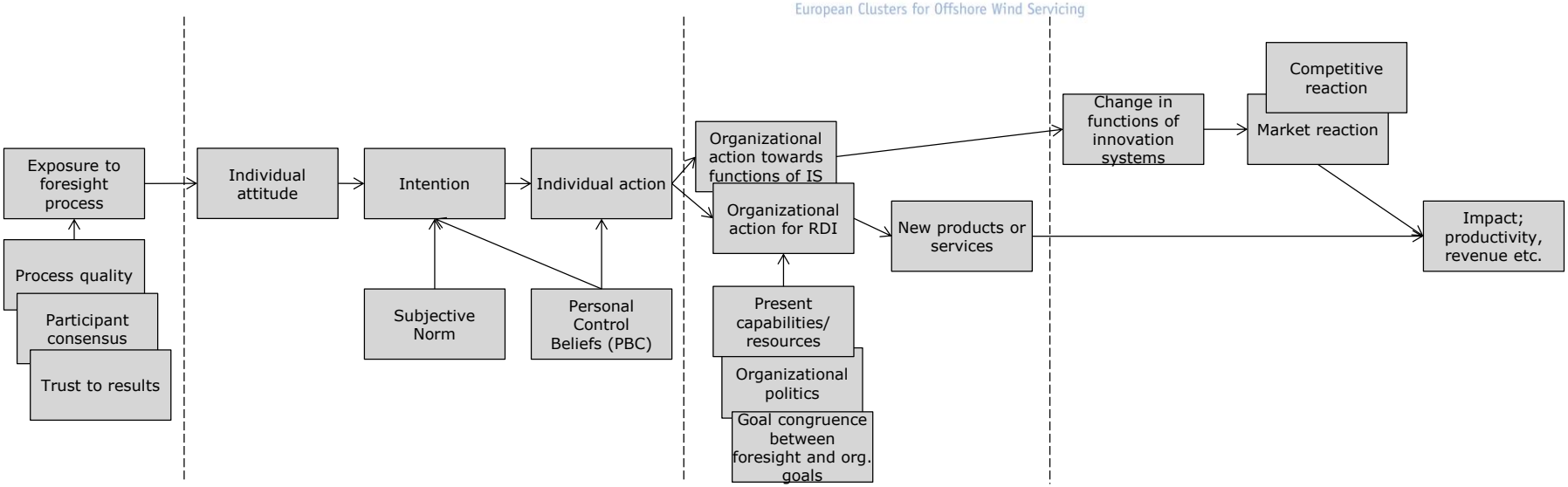

Figure 15: Impact logic for foresight

To condense and sum, thus we propose that the impact of foresight is tied to the ability of the process to affect the attitudes and behavior of the participating actors and stakeholders. The behavior can be directed to both framework conditions, the functions of innovation systems and RDI activities. Further, we propose that the behavioral change is moderated by the norms and self-efficacy of the participants and stakeholders; the present capabilities, resources, previous development path and organizational politics of the involved organizations; as well as the state of the innovation system.

If we look the proposal of foresight impact critically, it is plausible as such, but the chain of effects does not necessarily correspond to practical experiences. This may be attributed to the length and complexity of the chain. Starting from the left, it can not necessarily be assumed that the foresight exposure is a black box that will automatically change attitudes towards action favorably, as such change is dependent on the process attributes, setting and acceptability or presentation of the output (e.g. Calof, Miller, & Jackson, 2012; Calof & Smith, 2010). Loveridge's (2001) analysis of foresight supports this conclusion; he argues that "there is no such thing as *institutional* foresight, though there are aggregations of individual perceptions that are brokered or negotiated into what is *represented* as an institutional and truly ecological property" (Loveridge, 2001, p. 782, emphasis added). This is to say that foresight is a negotiation process where individual and organizational interests are argued and which in the best of cases converge to a compromise that engages the participants.

Another hurdle, so to speak, comes when an individual exposed to the foresight, assuming the outputs are agreeable and actionable personally, starts to act within his or her own organization to implement the implicated actions/behaviors. Here the resource based view of the firm (RBV) predicts that present resources and past development path constrain action on the level of the organization together with organizational politics. This effect could be perhaps called organizational self-efficacy, which sets the boundaries for individual self-efficacy and control beliefs that in turn moderate willingness and ability to act on the foresight outputs and the volume of activity towards the goals. Going one step deeper, much of the impact can be reduced to incentives, or perceptions of value, risk and return associated with the foresight results, i.e. people are motivated by lucrative risk-return relationships. Similar conclusions have been presented by Salo (2001), Calof et al. (2012) as well as Calof and Smith (2010).

The activity induced by foresight can in turn be focused towards framework conditions and institutions on the inter-organizational level, or RDI activity within the organization, which will bring the tangible impact of foresight. However, here may lie the largest uncertainty, as is has been observed that the quality of a foresight project, in terms of quality of execution, methods and delivery, has little to do in terms of ultimate impact of a foresight exercise compared to political positioning and establishing communication channels to relevant decision makers. (Calof et al., 2012; Johnston, 2012)

To sum up, this chain of reasoning gives our proposed answer to the question why foresight has an impact. We argue that foresight will have an impact, 1) if it produces an output that is actionable, in terms of presentation and self-efficacy, and agreeable to the participants/actors, i.e. consistent with individual and organizational norms and goals, and 2) if the innovation system allows for the impact to emerge.

APPENDIX 2: Documentation of collaboration instances

The following template poses questions for documenting RDI collaborations which may or may not be associated with ECOWindS. The template is a guideline to aid in documentation. It can be used in conjunction with the interview guide (see following appendix) and to identify case studies for the SCM.

Dimensions	**Questions**
Informant/contact person	• Name • Organization • Size of organization: Small/Medium/Large • Type: Enterprise/research institution/administration • Relationship to ECOWindS (Process participant/somehow associated/non-associate)
Partner organizations	For each known partner: • Organization • Contact • Relationship to ECOWindS (Process participant/somehow associated/non-associate)
Type of collaboration	• New contacts between enterprises • New partner negotiations • New working groups and other loose collaborations • New RDI projects, including private RDI, collaborative RDI between enterprises and public-private partnerships • New joint ventures
Objectives of RDI collaboration	• The main aims/goals
Start and duration	• Start date or date of documentation • Duration as far as known
Description	• Overview to activities

APPENDIX 3: Interview template

The following can be used as an interview guide for ECOWindS JAP evaluation when interviewing informants for the case studies.

Background information

Name of interviewee:
Organization:
Position:
Size of organization: Small/Medium/Large
Type: Enterprise/research institution/administration
Relationship with ECOWindS: Process participant/somehow associated/non-associate
Have you heard of ECOWindS JAP, International Cooperation Strategy, Regional Mapping analysis?

Themes

What new innovations or collaboration have you seen in the industry, in your own or other organizations?

Who are the partners/contact persons as far as you know?

What was the main driver for collaboration? E.g.:

- Private strategic intent/objectives/roadmaps
- Market/customer request
- Opportunity from recognized complementary strengths
- Industry/trade association initiative
- Collaborative project

What other influences there were?

- Regulation and energy policy
- Renewables incentives
- Competition between energy technologies
- Energy prices
- End-user/consumer preferences

Where did the idea come from?

- Basic/applied research
- Own RDI
- Competitors
- Existing customers
- Customer prospects
- Collaborators
- Combination of above

Did the project require new competences, expertise of knowledge?

What was the outcome of the collaboration?

What contributed to the success (or failure)?

What will you do next?