Using the Industry Collaboration Canvas in the Mid-Term Review. Experience in applying the framework in the oil and gas industry.

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Abstract

The SIRIUS Centre for Scalable Data Access in the Oil and Gas Domain is funded by the Research Council of Norway and hosted by the University of Oslo. It pursues fundamental research that drives innovations related to digitalisation of the oil & gas industry. The centre consists of researchers from four institutions (University of Oslo, NTNU, Simula Research Centre and University of Oxford) and fourteen companies in the oil and gas supply chain. It is funded for eight years from 2015 and is now undergoing a mid-term review that assesses the centre's progress and determines whether it will be funded for its full term.

To prepare for the review, it was necessary to have a structured discussion with each industrial partner. This was done to determine how successful the partnership had been to date, see if any changes needed to be made and sketch a plan for the last half of the centre's life. The assessment required a tool that was simple to use, easy to understand and flexible. We chose to use the Industry Collaboration Canvas of Frølund, Murray and Riedel (2018). This paper describes the process and results of this work, from the perspective of the centre management and two of the larger partner companies, Equinor and TechnipFMC.

Two workers were trained in the use of the canvas in March 2018. The process was explained to the partners at the centre's general assembly and it was agreed that we would conduct these workshops. The workshops were then held in the second half of 2018. SIRIUS management visited each partner's site to hold the meeting. However, in some cases, videoconferencing had to be used due to the geographical factors.

The use of the canvas was considered to be successful. Feedback from all participants was positive and the information gathered provided factual material for preparing the documents needed for the mid-term review. In all cases, we identified concrete actions that will improve the value of collaboration between the researchers and each industrial partner. The canvas identified gaps and potential problems for collaboration. In these cases we were able to agree on necessary corrective actions. The canvas is now shared between centre management and the partner and is a de-facto agreement on how the partnership will continue over the next 5 years.

The canvas is an effective and powerful tool for assessing and planning interactions between researchers and industrial companies. It is simple to use, easy to understand and brings rigour and structure to the discussions around current and new collaborations. We are actively promoting the use of this tool in other parts of the University.

1   Introduction

SIRIUS is a Centre for Research-based Innovation, or SFI[1] (RCN, 2019), funded by the Research Council of Norway and hosted by the University of Oslo. Its theme is *scalable data access in the oil & gas domain.* The centre brings together computer scientists from four academic institutions (University of Oslo, University of Oxford, NTNU and Simula Research Centre) to work with fourteen companies. Twelve of these participated in the canvas process. These companies are a diverse collection of SMEs (Dolphin Interconnect Solutions AS, Numascale AS, Kadme AS), Nordic IT companies (Computas AS, Evry ASA), international IT vendors (IBM, SAP and OSIsoft) and large industrial companies (Aibel, Aker Solutions, DNV GL, Equinor, Schlumberger, TechnipFMC). Together they cover the entire oil & gas supply chain, especially the flow of information between vendors and operating companies. This centre has been described in detail in a previous UIIN conference paper (Cameron and Østerlie, 2018).

As noted in that paper, SIRIUS is a complex organization that implements a variant of the hybrid-autonomous organization. Here academics, IT vendors and end-users try to find common spaces for combining computer science research with the digitalization challenges of the oil & gas industry.
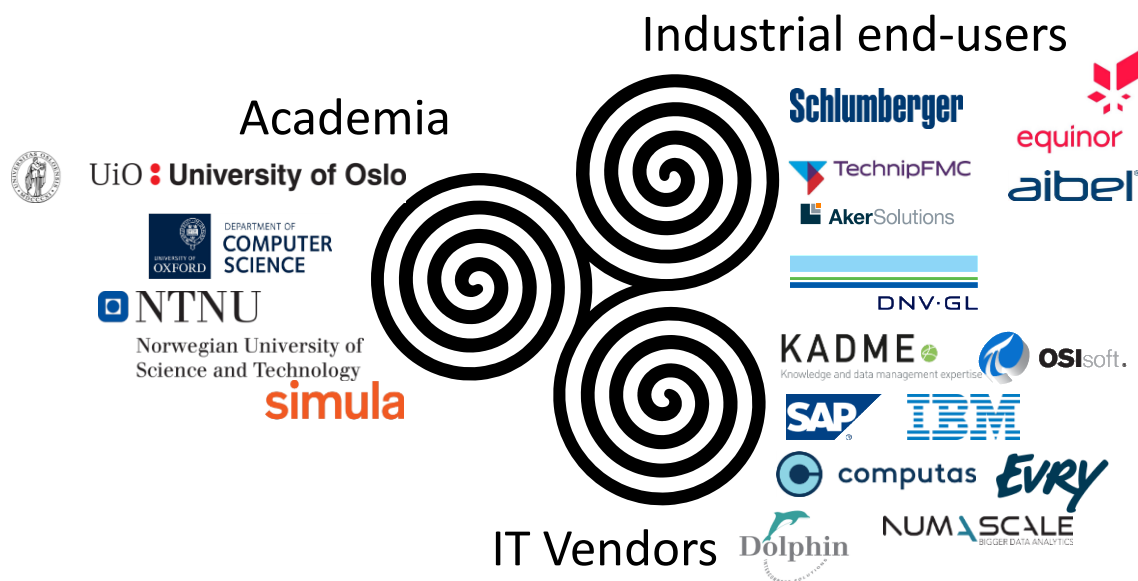

Figure 1: SIRIUS as a Triple-Helix Organization

SIRIUS has many partners, with diverging interests and motivations. Finding the common space for interaction has been a core activity in the life of the centre. This process has been demanding. It requires hard work in meeting with different organizations to build common understanding, establish common incentives to work and define common

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[1] A Norwegian acronym for *Senter for Forskningdrevet Innovasjon.*

activities. This work has resulted in an ambitious set of interlinked research programs and beacon projects, where computer science research is linked to business problems in and beyond the oil & gas industry (SIRIUS, 2019). See Figure 2.

Beacons built on a common foundation

WP1 Exploration	WP2 Operations	WP3 Cross-domain applications
Geological assistant	Integrated digital planning	Personalized medicine
Subsurface data access & analytics	Digital twins	Environmental applications
Digital field & reservoir management	Digital field development	

WP4 Research Programmes

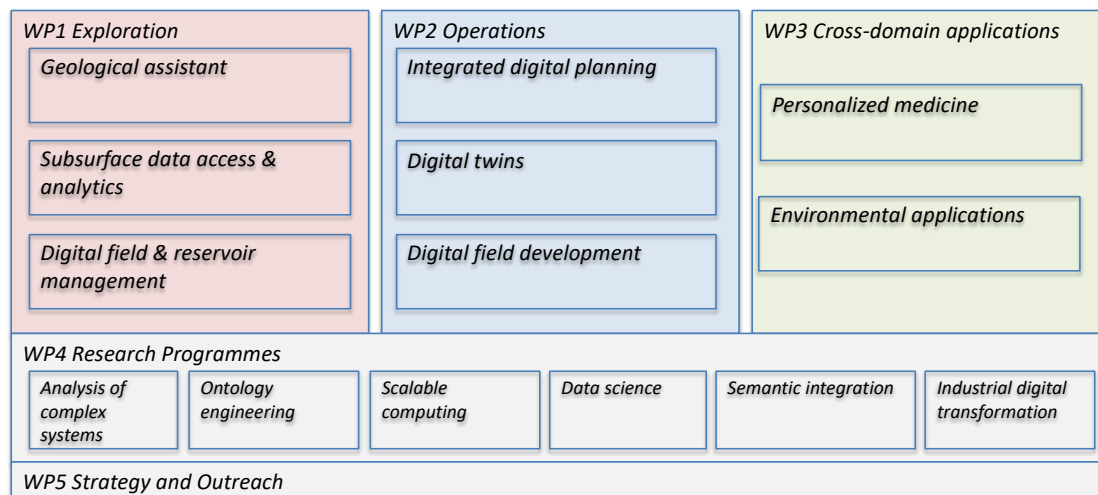| Analysis of complex systems	Ontology engineering	Scalable computing	Data science	Semantic integration	Industrial digital transformation

WP5 Strategy and Outreach

Figure 2. The research programs and beacon projects in SIRIUS.

As mentioned above, SIRIUS is funded by the Research Council of Norway, the University of Oslo and the partners. Every SFI is subject to a mid-term review, after around three and half years of operation, to assess progress and determine whether the centre should be funded for the remainder of its eight-year life. The review for SIRIUS was held in March 2019, on the basis of documentation delivered to the Research Council in December 2018. In preparation for this, the management of the centre wanted to consult with their partners to assess progress, capture problems and issues and prepare plans for the remaining life of the centre.

The management of SIRIUS had been made aware of the University Industry Innovation Network (UIIN) through contacts in OSIsoft, a SIRIUS partner. This resulted in the first author becoming a personal member in UIIN and attending a workshop, with a colleague, on the use of the University Partnership Canvas. After this workshop, it was proposed to try out this tool as a way to engage with our partners in preparation for the mid-term review.

The rest of this paper describes and assesses our experience. We first describe the mid-term review in more detail, identifying the success criteria that the canvas can help us to analyse. This is followed by a description of how we did the canvas work. Modifications we made to the approach are described and assessed. We then present and discuss the experience of two of the companies, TechnipFMC and Equinor. Equinor was a founding company in the centre and has a cornerstone role. Knut Sebastian Tungland, one of the co-authors, is Chairman of the centre's general assembly. TechnipFMC, on the other hand, only joined SIRIUS in 2018. Elisabeth Nøst, another of the co-authors, manages

TechnipFMC's relationship to SIRIUS. After this, we present how the results of the canvas process were used to formulate our revised plans for the next five years of the centre's life.

2   The mid-term review

The procedure for a mid-term review is published by the Research Council of Norway (RCN, 2018). The purpose of the review is to assess whether we are meeting the aims of the SFI program (RCN, 2018):

> *The SFI scheme shall:*
>
> *   *Encourage enterprises to innovate by placing stronger emphasis on long-term research, and by making it attractive for enterprises that work on the international arena to establish R&D activities in Norway.*
>
> *   *Facilitate active alliances between innovative enterprises and prominent research groups.*
>
> *   *Promote the development of industrial research groups that are on the cutting edge of international research and are part of strong international networks.*
>
> *   *Stimulate researcher training in fields of importance to the business community, and encourage the transfer of research-based knowledge and technology.*

These aims are then detailed into success criteria for research excellence, innovation & value creation, internationalization, research training & recruitment, partners & funding and organization. The review is done by four evaluators: two specialists and a two generalists. They base their assessment on written material: a report of our progress, a description of the centre's plans for the rest of the funding period and evaluations from each partner.

3   The Partnership Canvas

The partner canvas we used is that described by Frølund, Murray and Riedel (2018) and Frølund & Riedel (2018). This canvas is called a University Partnership Canvas or an Industry Partnership Canvas, depending on whether it is the industialists or the academics who are working with it. We decided to create a common canvas, that documented the views of both the company and the centre on a single document.

The partnership canvas analyses the relation between the company and the academics using six discussion points. As part of the mid-term evaluation, each company was asked to fill out a questionnaire, that they sent directly to the Research Council. We therefore

mapped the points in the canvas to the questions in the Research Council's questionnaire. This mapping is shown in the following table.

We saw that the canvas could be used to help both the academics and the companies in their preparation for the review. It provided a way to evaluate rigorously our relationship so that we could identify opportunities, problems and challenges in advance of the review and agree on a common strategy for the next phase of the centre.

As noted above, the first author learned about the canvas through a UIIN workshop on its use. At the workshop, a canvas of the centre, from his perspective was prepared. The insights and analysis of this work were promising, but as a "new convert" we needed to spread the message in an effective way. This was done at the centre's general assembly in May 2018. The canvas was introduced, together with the summary keywords and the mapping to the Research Council's questions. It was agreed that a meeting would be held with each partner between August and November 2018. Where possible, the meeting was held at the companies' offices, as this would (a) allow broader participation from the company and (b) allow SIRIUS academics to visit company sites. This was done with two exceptions: Equinor used a videoconference, as their process involved staff in Bergen and Stavanger, and OSIsoft held their meeting at their European User Conference, as this provided best access to staff who were usually located in the United States.

Item	Canvas description	Keyword	Research Council questions
1	GOALS What business goals drive your university partnerships?	WHY?	1.Describe the focus of own R&D in thematic area of the centre, within and outside the centre (strategic platform) 2. What is total volume of R&D within company in thematic area of the centre.
2	FOCUS AREAS What are the key focus areas of your university partnership, and how are they selected to ensure alignment with your business goals?	WHAT?	5. What opportunities have been created that would not have existed without the centre?
3	PARTNERS Who are your primary university partners, and by what criteria are they chosen?	WHO?	3. How has the participation in the centreinfluenced the R&D activity of your company?
4	FORMATS What collaboration formats match your focus areas and business goals?	HOW?	4. How has the partner interacted with the centre?
5	PEOPLE, PROCESSES, AND ORGANIZATION What people, processes, and organizational structures support your university partnerships?	SUPPORT?	8. On a scale from 1 (Low) to 6 (High), please give your score for each of the following questions: *this was scoring of influence on strategy,management and academic competence and impact.*
6	EVALUATION What key performance indicators are most useful for evaluating your university partnerships?	CONTROL?	6.Has the centre contributed to specific innovations within your company? 7.Can you give any estimate of potential for increased income or reduced cost in net present value as aresult of being a partner in the centre?

Table 1. The canvas mapped to keywords and questionnaire questions.

4   How we adapted the partner canvas

The meetings used the partner canvas content as proposed by Frølund, Murray and Riedel. However, the "canvas on the wall" approach was not suitable for our meetings. The meeting rooms we used were not suitable for walking around with post-it notes. This was also not possible when videoconferencing was used, as was the case with Equinor and IBM. We adapted the canvas into a set of slides, with each element of the canvas as a blank page, with the heading and description. Prefaratory slides gave a short explanation of the canvas and the "cheat sheets" for new and existing partnerships that were supplied at the UIIN workshop. Each participant was given a printer copy of the slides in the meeting, This allowed them to make their own notes before, during and after the meeting. We showed the slides on a screen, but only as a mechanism for focusing and moving the discussion along.

We aimed to have several participants from the centre and the following participants from the company: the company's main contact, their management sponsor and staff who were involved in the centre's projects. SIRIUS' centre coordinator attended all the meetings and was facilitator and secretary for the meetings.

The meetings followed a standard procedure. After introductions the coordinator spent 5-10 minutes presenting the prefaratory material in the slide deck and agreeing the agenda for the meeting. We then started at point one, asking the industrial partner to describe their goals and motivations in joining the centre, and whether they had changed since the centre started. This proved to be a good "ice-breaker" question, and led naturally on to the other topics.

Table 2 summarizes the features of each canvas session, without identifying the company involved.

Company	Type	Date	Venue	SIRIUS participants	Company participants
A	Existing	Sept. 2018	Company	2	3 (Sponsor, contact and project collaborator)
B	Existing	Oct. 2018	SIRIUS	3	2 (Sponsor and contact)
C	Existing	Oct. 2018	Company	1	1 (CEO)
D	Existing	Oct. 2018	Videoconferenece	3	4 (Sponsor, contact, R&D contact and project collaborator)
E	Existing	Oct. 2018	Company	2	2 (Contact and industry business developer)
F	Existing	Aug. 2018	Videoconference	2	4 (Technical and administrative contact, industry expert, project collaborator)
G	Existing	Sept. 2018	Company	2	2 (CEO and contact)
H	Existing	Nov. 2018	Company	1	2 (CEO and technical collaborator)

Company	Type	Date	Venue	SIRIUS participants	Company participants
I	Existing	Sept. 2018	At company conference	1	4 (Sponsor, contact, project collaborator and university relations owner)
J	New	Sept. 2018	Company	1	2 (Sponsor, contact)
K	Existing	Sept. 2018	Company	2	3 (Sponsor, contact, project collaborator)
L	New	Aug. 2018	Company	4	4 (Sponsor, contact, project collaborators)

Table 2. The Partner Canvas Meetings

Here we will focus on two canvas processes: for Equinor (company D) and TechnipFMC (company L). We will then conclude by making some general comments about the answers we received for each item in the canvas.

5   Equinor: a cornerstone partner

Equinor, formerly Statoil, is a cornerstone partner in SIRIUS. They are currently the only operating company in the consortium. This means that they "own" many of the industrial problems that SIRIUS is aiming to solve. Equinor's primary contact, Knut Sebastian Tungland, is Chairman of SIRIUS' board and works in Equinor's Digital Centre of Excellence. Formally, the SIRIUS contract is owned by corporate R&D, with their own representative in the centre. The canvas meeting was held with both of these contacts and two representatives from Equinor's business units: a sponsoring manager with responsibility for a business digitalization program and a technical specialist with responsibility for an operational discipline in the company. We also received written input from another technical specialist.

These personnel were based in Stavanger and Bergen, so it was necessary to use video-conferencing. This made it difficult to structure the discussion sequentially, so instead we let each participant talk about their concerns and the centre coordinator then tried to link each point to its relevant place in the canvas. The results were circulated after the event for review, comment and correction.

From Equinor's perspective, that they were challenged to provide feedback in the canvas mean that they were able to do a retrospective analysis that otherwise would not have been done. This analysis was useful. Equinor's participants evaluated what they believed to be the most important aspects of the centre and why Equinor was part of the centre.

Equinor has a broad engagement in the centre. This meant that the canvas was not used for each specific activity, rather for the overall engagement. It was also not possible to engage all participants in SIRIUS activities.

A consistent theme was that, thus far, the centre had not provided the hoped-for collaboration with other industrial partners. Perhaps the initial composition of the centre was not well-aligned with the type of challenges that Equinor sees. The centre is growing, with new participants, some of whom were recruited with Equinor's support, will address this problem.

Equinor's participants in the canvas process also noted that neither the centre nor the company had established key performance indicators to measure Equinor's success in participating in the centre. We will revisit this topic in section 7.7 below.

6   TechnipFMC: a new partner

TechnipFMC is a global engineering and oil services company, with a substantial presence in Norway. Until newly, the company's Chief Digital Officer was based in Oslo.[2] The management for the company's Digital Services & Innovation Centre (DSI) is also in Oslo. TechnipFMC's SIRIUS contact, Elisabeth Nøst, works in the DSI. TechnipFMC joined SIRIUS in August 2018 and a canvas workshop was held at their offices late in the month. The meeting included the centre coordinator, centre director and leader of the data science research program from SIRIUS. TechnipFMC was represented by the contact, the management sponsor (head of the DSI), a business representative from the CDO office and a project collaborator.

As a new partner, we used the canvas process to formalize our expectations and explore ways to interact. The company had a clear set of goals in joining SIRIUS, built on the need to ally with academia to support internal initiatives in data science and digital services. SIRIUS provides a framework for collaborating with operating companies' (customers') digitalization projects and collaborating with other companies in the supply chain. No digitalization initiative in the oil and gas industry is truly totally internal to a company.

As a service company, TechnipFMC focused primarily on the operations beacon projects. However, they are also a technology provider. This means that data science and semantic technology are focus areas in their own right.

TechnipFMC is a global company, with several business units. The partners and people, processes and organizations pages in the canvas provided a way to identify and document who in the company could be interested in SIRIUS' work. They provide us with a list of initiatives to build project ideas and develop a joint innovation pipeline.

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[2] A reorganization was announced in April 2019, where the responsibilities of the Chief Digital Officer were combined with those of the Chief Information Officer. IT and digital services are also combined in the new organization. The Digital Services & Innovation Centre continues as before. See https://e24.no/energi/jobbytte/ann-christin-andersen-slutter-i-technipfmc/24596854.

7 Overall findings and future actions

7.1 Introduction

Each partner canvas is used as a shared document that describes the relationship between each partner and the centre. We plan to keep the documents living, as a basis for developing the strategy for each of our beacon projects and research programs. As new partners join the centre, we will use the canvas to define the relationship between the company and the centre.

7.2 Goals. Why?

With twelve partners, there were many goals behind participation in the centre. However, we saw several common features:

- Vendors want to use the centre to gain access to end user's problems and thereby expose, benchmark and improve their hardware, software and services.
- All partners wanted to use SIRIUS as a forum for building collaboration between companies around research problems in the centre. Several partners talked of a "forum" or a "community vision".
- Partners see the centre as a means to build the digital competence of their personnel and influence internal R&D work.
- Participation in the centre was built, for core initial participants, around existing relationships in European research projects.

From the academic side, we emphasized our need to work with real industrial problems and real data sets, engage with end-users of technology and prototype our technologies in our partner's products and systems.

7.3 Focus Areas: What?

The focus areas page was used to identify the technical areas in which the company is interested. We saw that no partner was interested in the entire portfolio of projects, and that the focus areas varied according to company type. Equinor, TechnipFMC and Schlumberger expressed their focus in terms of business needs, in exploration or operations. Vendor companies looked at both technology and applications. Every company limited their focus to relevant parts of the portfolio. However, all companies were aware that they needed to engage both with technology and applications.

7.4 Partners: Who?

We used the partners discussion to map the company's research interests to the specific research teams and projects in the centre. SIRIUS has a complex matrix structure, and not all partners were aware of the scope of our work. This allowed us to document existing

contacts and identify new areas. We were also able to identify existing and potential contacts in the company. In large companies, like IBM, Schlumberger, TechnipFMC, SAP, DNV GL and Equinor, this provided both consolidation of existing contacts and exploration of potential further out in the company.

7.5   Formats: What?

The formats identified varied from company to company, but included the following mechanisms.

- Many partners see SIRIUS as a forum for gaining and sharing knowledge. Our activities that create places to meet and share research ideas and results were encouraged
- A laboratory for software and hardware is a necessary part of the centre.
- Innovation projects, with several companies and research groups are seen to be essential to generating value. These need to be funded, so we need to be pursuing money from the Research Council, European Union and Joint Industry Projects.
- SMEs and service companies depended on external funding or payment from operating companies to participate in innovation projects.
- Placement of researchers in companies is possible and desirable.
- Seminars and workshops are vital for building collaboration networks and shared understanding.
- SIRIUS' mentoring program is a valuable way of building relationships.
- There is a strong willingness to host interns, M.Sc. projects and summer students. This willingness needs to be met with recruitment of suitable students and changes to curricula that support this exchange.

7.6   People, Processes and Organization: Support?

The people, processes and organization page was used to generate a relation map for the partnership. We placed the names and roles of key people or organizations on the page and drew actual or desired communication paths between these people. This page was used for documentation of the relationship. In addition, Equinor noted that each of the business beacon projects in SIRIUS should have a reference group from companies, who would be responsible for the business case for that project.

7.7   Evaluation: Control?

The mid-term evaluation criteria from the Research Council listed one key performance indicator for innovation: number of patents. Our partners agreed that this was a poor measure of success for a centre like SIRIUS. Instead, they came with the following success criteria and KPIs.

- Milestones and deliverables

- o Compelling demonstration of a prototype or pilot at a corporate customer or end-user conference.
- o Innovation projects initiated and run successfully.
- o Number of workshops or knowledge exchange events held.
- o Changes made to work processes, products or systems in company.
- o Exchanges of personnel, internships and M.Sc. projects.
- o Joint publications.
- o Recruitment of students and graduating centre personnel.
- Qualitative criteria
  - o Qualitative description of value of collaboration.
  - o Competence transfer and increases in organization.

8   Conclusions and recommendations

Our experience in using the Partner Canvas is positive. We can recommend its use in any context where a company or research group is documenting and evaluating their relationships to external organizations. The framework is simple to understand but asks relevant and, sometimes difficult, questions. The standardised approach allows companies to prioritize this assessment and use resources in way that would not have been possible with an informal, unstructured, status review.

At the time of writing, we have not received formal feedback from the mid-term review, held in March 2019. However, comments from the reviewing panel were very positive when we described the use of the canvas. Centre management will continue to use these canvases as "de-facto contracts" for each partner. Changes in relationship between the company and the centre are documented in the canvas documents, which will serve as living documentation of the relationship between company and the centre's academics. We will propose to the partners at the next General Assembly that we will repeat the canvas meetings annually or semi-annually.

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