INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED15
27-30 JULY 2015, POLITECNICO DI MILANO, ITALY

HOW TO SEARCH FOR OPEN INNOVATION PARTNERS?

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Abstract

Open Innovation (OI) allows the utilisation of external expertise. This can increase the customer integration, reduce the time to market and reduce products' flop rates. However, companies still face challenges when planning and conducting OI. A major issue is the identification and selection of suitable partners (so called OI-actors). Besides OI-actors with specific technical capabilities for solving the primary issue/task of the OI-project, also relevant OI-actors in terms of power and influence need to be involved. In the context of Situative Open Innovation (a methodical procedure model for planning OI-projects), we developed a methodology for identifying suitable OI-actors. Starting with an analysis of existing stakeholders, in the following different search methods are proposed - including a decision support for selecting specific search methods. Identified potential OI-actors are assessed and ranked from a technical and a strategic perspective, and generic cooperation strategies derived for selected OI-actors. By the use case of an industrial project we demonstrate the methodology's applicability and benefit but also show points for further improvements.

Keywords: Decision making, Open Innovation, Project Management, Situative Open Innovation

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Please cite this paper as:
Guertler, M. R.; von Saucken, C.; Schneider, M.; Lindemann, U.: *How to search for Open Innovation partners?*. In: Proceedings of the 20th International Conference on Engineering Design (ICED15), Vol. 8: Innovation and Creativity, Milan, Italy, 27.-30.07.2015

1 INTRODUCTION

The basic idea of Open Innovation (OI) is the purposeful use of distributed knowledge both inside and outside the company (Chesbrough, 2003), (Chesbrough and Bogers, 2014), (Dahlander and Gann, 2010). More figuratively, companies are opening up their innovations processes to allow knowledge exchange and collaboration with external actors (Braun, 2012), (Gassmann et al., 2010), (Sloane, 2011). From a company's perspective, the utilisation of external expertise allows various advantages such as higher customer integration, reduced flop rates or a reduced time to market (Braun, 2012), (Enkel et al., 2009). However, besides these positive aspects, there are also challenges which can risk the success of OI (Enkel, 2009). Often these risks are related to an insufficient methodical support. Guertler et al. (2014b) analysed the industrial application of OI focussing on small- and medium-sized enterprises (SME) and derived nine fields of industrial OI-demands. These served as foundation for developing a methodical framework, called "*Situative Open Innovation*" which supports companies by planning an OI-project (Guertler and Lindemann, 2013). Within this paper, we are addressing one of the nine demand fields, which is directly related to the distributed nature of OI-knowledge: the identification of suitable OI-actors. As different reports from industry and academia show (e.g. (Enkel, 2009), (Guertler et al., 2014b), (Huizingh, 2010), (van de Vrande et al., 2009)), the identification of suitable OI-actors is essential for the success of OI. It defines the knowledge input into the OI-project but also might cause risks such as uncontrolled knowledge drain. The study showed, choosing the right OI-actors is still a challenge for companies. The resulting questions are: *How can a project team be methodically supported planning an OI-project?* Focussing on: *How can potential OI-actors be identified and ranked regarding their suitability for the OI-project?*

This paper presents a methodology for a purposeful search and assessment of potential OI-actors. For this, it combines elements from stakeholder (SH) analysis and Lead-User identification. Starting from an analysis of the goal of the OI-project and its OI-situation (context factors), suitable search methods are proposed. The utilisation of method profiles supports the OI-project team by selecting suitable search methods. In the end, identified potential OI-actors are assessed and ranked by assessment attributes defined within the initial analysis step. The selection and application of suitable search strategies was initially evaluated in the context of an industry project. Though it is still work in progress, the evaluation proves the applicability and benefits of the OI-actors search methodology.

2 SITUATIVE OPEN INNOVATION (SOI)

Guertler and Lindemann (2013) present a methodical procedure model, called **Situative Open Innovation (SOI)**, supporting companies and academia planning an OI-project. It was developed based on the identified industry demands. Since most of the demands address or are dependent on the planning stage of an OI-project. Figure 1 depicts an enhanced model of SOI. It consists of five phases, which can be differentiated into two areas: the outer ring for the rough planning and the centre for the detailed planning of an OI-project. Though the structure appears linear, iterative jumps to previous phases are possible if intermediate results are insufficient or context factors change. To allow purposeful iterations, the model uses stage-gates "*SG*" (based on: (Cooper and Edgett, 2009)) to control the progress of the project planning. In the following, we give an overview of the five phases:

SOI 1: Analysis of OI-situation and OI-objectives

In the first phase, the OI-project's goal and the OI-situation in terms of internal and external context factors are analysed. They set the boundary conditions and constraints for the following phases.

SOI 2: Selection of OI-actors

Based on the results of SOI 1, this phase identifies potential OI-actors, assesses and ranks them as well as supports the final selection and derivation of according generic cooperation strategies. This paper focusses on aspects of the OI-actors identification and assessment.

SOI 3: Selection and adaption of OI-methods

This phase identifies suitable OI-methods based on the results of the phases SOI 1 and SOI 2. Usually it is an iterative process with SOI 2 to derive matching combinations of OI-actors and OI-methods.

SOI 4: Planning of OI-project management

In this phase, key-performance-indicators and controlling concepts are defined to allow an efficient project controlling. This phase also identifies potential risks and defines risk management strategies.

SOI 5: Detailed planning of OI-project

This phase addresses the detailed planning of the previously defined OI-project setup, e.g. the specific start and duration of the project or specific risk management measures.

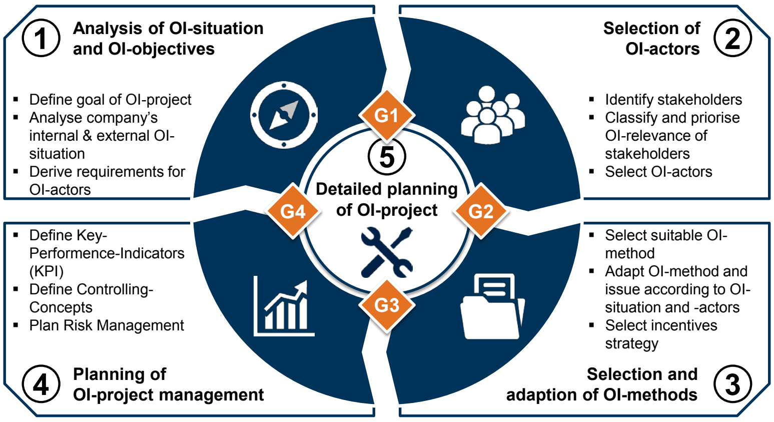

Figure 1. Situative Open Innovation (based on: (Guertler and Lindemann, 2013))

3 STATE OF THE ART OF IDENTIFYING PROJECT PARTNERS / ACTORS

A challenge by identifying and selecting suitable OI-actors is often a missing or insufficient consideration of the combined technical and strategic potential of an OI-actor (Guertler et al., 2014b). While the OI-project requires a specific technical potential of the OI-actors in order to solve a technical task, the strategic potential indicates an OI-actors influence on other OI-actors or the success of the OI-project. For instance, by neglecting the differentiation between users and actual buyers a manufacturer of a wheel-walker reduced the product's success (number of sales) (Guertler et al., 2014b). Thus, it is essential to consider both perspectives when planning an OI-project.
Our integrated OI-actors search methodology for identifying and assessing OI-actors combines two established approaches for each perspective: Lead-User identification for the technical perspective and stakeholder (SH) analysis for the strategic perspective. By the analysis of different SH analysis and Lead-User identification processes, Guertler et al. (2013) show that both approaches are complementary in terms of OI and offer great possibilities if combined.
The **Lead-User approach** was developed by von Hippel (1986) and continuously enhanced over the years (Herstatt and von Hippel, 1992), (von Hippel, 2005), (von Hippel et al., 2006), (Sänn and Baier, 2012). It focusses on the identification and involvement of users with specific needs as well as skills and expertise. Lead-User identification methods are useful for OI as they allow the identification of technical capable OI-actors who can contribute to a solution of the (often) technical task of an OI-project. They also support the identification of OI-actors who have not been known to the company so far, e.g. experts from another industry. For this, Lead-User identification provides different methods:

- **Screening** (von Hippel et al., 2006)
  An existing pool of users is assessed by specifically defined criteria to identify Lead-Users.
- **Pyramiding** (von Hippel et al., 2006)
  By the use of a snowball approach, potential Lead-Users are identified and asked if they know other persons who might have expertise in a given field. These persons are then asked the same.
- **Netnography** (Belz and Baumbach, 2010), (Langer and Beckman, 2005)
  A given community (e.g. users of a specific product) is analysed to gain current discussion topics, needs, solutions and indications for outstanding users who can contribute to the OI-project.
- **Broadcast search** (Ili, 2010)
  By publishing a task (mainly) on a web-platform, interested persons can develop and hand in a solution for this task. The self-selection process ensures that only motivated persons participate. Based on the quality of the submitted solution, technically capable persons can be identified.

Stakeholder analysis focusses on the identification and assessment of all individuals and groups who have an interest, affect or are affected by a specific company, project or product (Bryson, 2004), (Freeman, 2010), (Mitchell et al., 1997). It also analyses dependencies between SH and their interests (MacArthur, 1997). This allows the identification of relevant OI-actors who have the power and

interest whether to support or to hinder the progress and outcome of an OI-project (Ballejos and Montagna, 2008). Based on the SHs' assessment some authors suggest generic cooperation strategies, e.g. (Lewis et al., 2007), (Mitchell et al., 1997).
Based on the analysis of different SH analysis and Lead-User identification processes (Guertler et al., 2013), an integrated identification and selection process for OI-actors was developed (Guertler et al., 2014c). Figure 2 illustrates an enhanced version of the regarding process.

4 IDENTIFICATION APPROACH FOR OPEN INNOVATION ACTORS

This section presents the integrated identification and analysis process for OI-actors and the underlying method profiles for selecting effective search methods in step 2 of the process. The term *OI-team* is used to name the team within a company, which is responsible for planning and conducting an OI-project.

4.1 Identification process

Based on (Guertler et al., 2014c), we further developed the integrated identification and analysis process for OI-actors, as shown in Figure 2. It represents a detailed version of "*SOI 2: Selection of OI-actors*" within the *Situative Open Innovation* and is framed by the analysis of the OI-situation (SOI 1) and the selection of suitable OI-methods (SOI 3).
The former step "Planning and Preparation" was subdivided into an analysis of the current and the intended state, and the definition of search directions. Elements from Lead-User identification are primarily used for searching for new potential OI-actors while SH analysis allows the analysis of the current state and the definition of search directions. To ensure a holistic assessment of potential OI-actors the *Screening* in step 3 is based on technical and strategic attributes defined in the beginning.

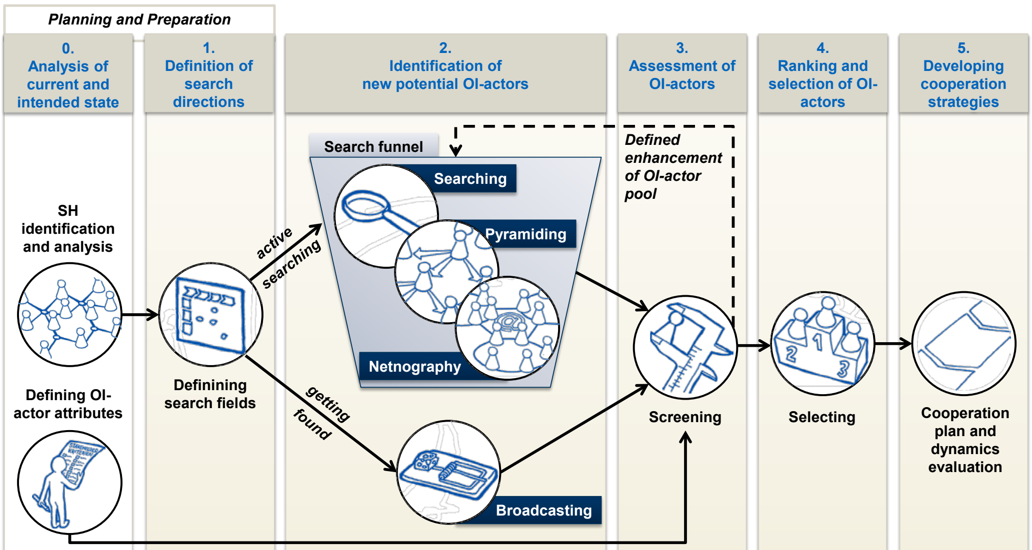

Figure 2. Search methodology for OI-actors

The search methodology for OI-actors consists of six steps, including one preparing step:

4.1.1 Analysis of current and intended state

This initial step identifies and analyses the current state of existing internal and external stakeholders of the company and the OI-project, analogously to a 'classical' SH analysis (Freeman, 2010). This can be assisted by a graphical OI-actor search map (Guertler et al., 2014c). By defining technical and strategic OI-actor attributes, the intended state of future OI-actors is specified. The attributes act as quasi-requirements for assessing potential OI-actors. To allow an efficient assessment, the attributes are categorised similar to KANO (Lindemann, 2009) into: KO-, performance and "nice-to-have" attributes (e.g. KO: knowledge about 3D-printing of plastics; performance: quantities of daily production; nice-to-have: own test centre). While KO and nice-to-have attributes are assessed binary, performance attributes can use a scale and be weighted regarding their specific relevance. This limits the later assessment effort: only potential OI-actors who fulfil the KO-attributes are analysed and ranked regarding performance attributes. Nice-to-have attributes can support decisions between two similarly ranked OI-actors. An approximate number of necessary OI-actors / groups is also defined.

4.1.2 Definition of search directions

Based on the goal of the OI-project and the OI-situation, this step uses a *Domain Mapping Matrix (DMM)* (Danilovic and Browning, 2007) to set up a search field matrix. Possible domains might be value creation process phases and types of stakeholder interactions. By mapping SH to these matrix fields, it is possible to get an overview of highly addressed fields and "white" fields, which have been mainly neglected so far. These white fields are potential search fields for the subsequent OI-actor search. However, some fields might need to be excluded based on constraints from SOI 1.

4.1.3 Identification of new potential OI-actors

This step identifies (new) potential OI-actors within the previously defined search fields. For this, two alternative paths are possible (Guertler et al., 2013), (Piller and West, 2014): (1) an *active searching* by the OI-team, or (2) a passive *getting found* by the OI-actors themselves. The *active searching* contains three search methods: *Searching* as a 'classical' search e.g. by search engines, *Pyramiding* (von Hippel et al., 2006) and *Netnography* (Belz and Baumbach, 2010). They are clustered in a search funnel representing an increasing focus level - from a broad *Searching* to *Netnography* focussing on one particular community. The passive getting found path contains *Broadcasting* (Ili, 2010) allowing a self-selection of OI-actors. All search methods can be applied independently or combined. Support for selecting a suitable search method offers the method profile presented in the next section.

4.1.4 Assessment of OI-actors

The identified potential OI-actors are assessed based on the OI-actor attributes, which were defined in the initial step. To allow an efficient assessment, OI-actors are first analysed regarding the fulfilment of KO-attributes. Subsequently, the principally suitable OI-actors are analysed in detail. If the number of suitable OI-actors is significantly lower than the defined number of necessary OI-actors, an iteration to the previous step with alternative search methods is necessary.

4.1.5 Ranking and selection of OI-actors

The previous assessment is the base for ranking the potential OI-actors regarding their relevance for the OI-project. Subsequently, in iteration with the following step, the OI-actors are selected. A method for ranking OI-actors and deriving generic cooperation strategies is presented by Guertler (2014).

4.1.6 Developing cooperation strategies

This step defines cooperation strategies for the selected OI-actors, which serve as boundary conditions for the subsequent selection of OI-methods in SOI 3. It is important to evaluate if the cooperation strategies are compatible with the OI-situation analysed in SOI 1. Otherwise, a lower ranked potential OI-actor needs to be chosen instead. (More details will be provided in a future publication.)

4.2 Method-profiles for supporting the selection of useful identification methods

Especially OI-unexperienced OI-teams require support for systematically selecting suitable search methods. For this, we use an adapted version of the OI-method model presented by von Saucken et al. (2015) and elements from underlying method models (Birkhofer et al., 2002), (Lindemann, 2009). It allows a compact depiction of the search methods. As shown in Figure 3 and according to von Saucken et al. (2015), the upper part of the profile contains a structured description of each method which gives an overview of the methods but also supports the decision between two similar suitable methods. The lower part is the primary basis for the identification of suitable methods. It contains different characteristics with possible properties, e.g. the *Type of method* can be a *search* or an *assessment*. The specific characteristics' properties of each search method are highlighted in the method profiles. This allows an easy comparison with the analysis results of the OI-situation from SOI 1. Besides these defined characteristics, also company individual factors should be considered, such as experience with a specific search method. Principally, each search method can be used in offline/face-to-face, online or by the use of intermediaries. The regarding type depends on possible constraints defined in SOI 1, such as need for secrecy due to a high competitive market.

	Criteria	Description	Properties			Sources
Method description	Input	What input (data, information) is needed to apply this method?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
	Goal	What is the specific goal of this method?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
	Procedure	What are the steps to conduct to perform this method?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
	Advantages	What are specific advantages of this method?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
	Nachteile	What are specific disadvantages of this method?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
	Output	What output (data, information) does this method deliver?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
	Examples	What are examplary applications of the method?	<textual description>			Birkhofer et al. 2002
	Relevant sources	Which are relevant literature sources to gain background knowledge of this method?	<textual description>			Birkhofer et al. 2002; Lindemann 2009
Goal	Typ of method	What is the type of the method?	search	assessment		
	Additional results	What are potential additional results besides OI-actors?	overview of topic	user needs	solutions	
	Degree of interaction	Does the method require an interaction with external actors?	none	useful	necessary	von Saucken et al. 2015
	Result focus	Does the method focus on a large number of results or a lower number with higher quality?	quality	quantity		von Saucken et al. 2015
	Identification of potential OI-actors	Who does the potential OI-actors identify?	OI-project team	other actors	self-selection	
	Degree of newness	How new or unknown are the identified actors to the company?	well known	vaguely known	completely unknown	
Preconditions	Existing infrastructure / tools	Does the method require specific infracture?	none	community	web-platform	based on: Birkhofer et al. 2002
	Concretisation of seach direction	How precise does the search direction need to be defined?	rough topic	precise terms	definition of task	based on: Birkhofer et al. 2002
	Already known OI-actors	Does the method require already known actors as a starting point?	none	single OI-actors	groups of OI-actors	based on: Birkhofer et al. 2002
Effort	Learning the method	How much effort is required to learn the application of the method?	low	high		based on: Birkhofer et al. 2002; von Saucken et al. 2015
	Preparation	How much effort necessary up front to conduct the method (e.g. for software implementations)?	low	high		based on: von Saucken et al. 2015
	Re-usability	Can the invested preparations (e.g. software) or search results be used for other searches?	no	yes, adapted	yes, directly	von Saucken et al. 2015
	Conduction	How much effort is the conduction of the method?	low	high		von Saucken et al. 2015
	Operationalisation	How much effort is the analysis of the identified OI-actors?	low	high		von Saucken et al. 2015

Figure 3. Method profile for OI-search methods

Figure 4 illustrates the search method profiles for the previously described search methods. Since it is the primary tool for distinguishing the methods, only the lower part is depicted due to space reasons. Though it is not a primary search method but still mentioned as method for identifying specific persons (i.e. Lead-Users) (von Hippel et al., 2006), also *Screening* is included into the method profiles. The regarding properties of each method are highlighted in darker colours. When planning the OI-actor search, the OI-team can check each method characteristic and its properties and compare them to the OI-goal and OI-situation, which were analysed in SOI 1 and documented in the form of an OI-attribute list (Guertler et al., 2014a). So far, the matching between the OI-situation attributes (e.g. need of concealment) and the method profiles (e.g. degree of interaction) is conducted manually. For the future, we plan to develop a semi-automated mapping and selection tool. It will also allow an explicit weighting of criteria (e.g. degree of newness vs. conduction effort) and ranking of methods.

	Criteria	Searching			Pyramiding			Netnography			Broadcast Search			Screening		
Goal	Typ of method	search	assessment		search	assessment		search	assessment		search	assessment		search	assessment	
	Additional results	overview of topic	user needs	solutions	overview of topic	user needs	solutions	overview of topic	user needs	solutions	overview of topic	user needs	solutions	overview of topic	user needs	solutions
	Degree of interaction	none	useful	necessary	none	useful	necessary	none	useful	necessary	none	useful	necessary	none	useful	necessary
	Result focus	quality	quantity		quality	quantity		quality	quantity		quality	quantity		quality	quantity	
	Identification of potential OI-actors	OI-project team	other actors	self-selection	OI-project team	other actors	self-selection	OI-project team	other actors	self-selection	OI-project team	other actors	self-selection	OI-project team	other actors	self-selection
	Degree of newness	well known	vaguely known	completely unknown	well known	vaguely known	completely unknown	well known	vaguely known	completely unknown	well known	vaguely known	completely unknown	well known	vaguely known	completely unknown
Preconditions	Existing infrastructure / tools	none	community	web-platform	none	community	web-platform	none	community	web-platform	none	community	web-platform	none	community	web-platform
	Concretisation of seach direction	rough topic	precise terms	definition of task	rough topic	precise terms	definition of task	rough topic	precise terms	definition of task	rough topic	precise terms	definition of task	rough topic	precise terms	definition of task
	Already known OI-actors	none	single OI-actors	groups of OI-actors	none	single OI-actors	groups of OI-actors	none	single OI-actors	groups of OI-actors	none	single OI-actors	groups of OI-actors	none	single OI-actors	groups of OI-actors
Effort	Learning the method	low	high		low	high		low	high		low	high		low	high	
	Preparation	low	high		low	high		low	high		low	high		low	high	
	Re-usability	no	yes, adapted	yes, directly	no	yes, adapted	yes, directly	no	yes, adapted	yes, directly	no	yes, adapted	yes, directly	no	yes, adapted	yes, directly
	Conduction	low	high		low	high		low	high		low	high		low	high	
	Operationalisation	low	high		low	high		low	high		low	high		low	high	

Figure 4. Systematic comparison of OI-actor search methods

5 EVALUATION

The search methodology for OI-actors was evaluated in an initial case study with an industry partner. As analysed in SOI 1, it was a SME from the field of machinery and plant engineering with solely B2B customers. Except theoretical knowledge about OI, no experience with OI existed but the responsible OI-project team was keen to test OI. The goal of the OI-project was the identification of R&D-partners for developing a new product from scratch. Though the company had already gained basic knowledge, this was only applicable in a laboratory scale. Besides the components design, especially the production process evinced to be difficult. Hence, R&D-partners with both product and process knowledge were needed. Since the company already had a wide network of collaboration partners from other R&D projects, the focus of the OI-project was on gaining a large pool of new, so far unknown partners - apart the "usual suspects". However, this broad search had one major constraint: secrecy. Since the competitors' strength on the market was high, even the smallest bit of information about the company searching in that particular product area would have been a strategic disadvantage. Hence, the search needed to be conducted incognito.

Within **step 0** (*Analysis of current and intended state*) of the search methodology, the existing network of external and internal SH was analysed. Due to the need of secrecy, it was important to identify negative SH and dependencies between them and other SH. This served as basis for the detail analysis in step 3 when analysing dependencies between new OI-actors and existing SH. Figure 5 shows a simplified empty and filled OI-actors identification map. For assessing the new OI-actors, five technical and five strategic attributes were defined. In the context of the broad search, especially the definition of KO-attributes (experience with a specific material and a production technology) was essential to manage large numbers of potential OI-actors and assess them with reasonable effort.
In **step 1** (*Definition of search directions*) a search field matrix was defined based on the SH-map, as illustrated in Figure 5. The two dimensions were phases of the product development process and product and process characteristics. By this, the existing SH could be mapped onto the search fields, which allows an overview where already several cooperation existed and where only a few or none existed. Especially the "white" fields were of interest for the following search as we were aiming on new OI-actors. Within the white fields, generic types of potential OI-actors groups were defined to support the following search. Also general search fields were identified, as depicted in the bottom line of the search field matrix, such as conferences, trade fairs or career portals.

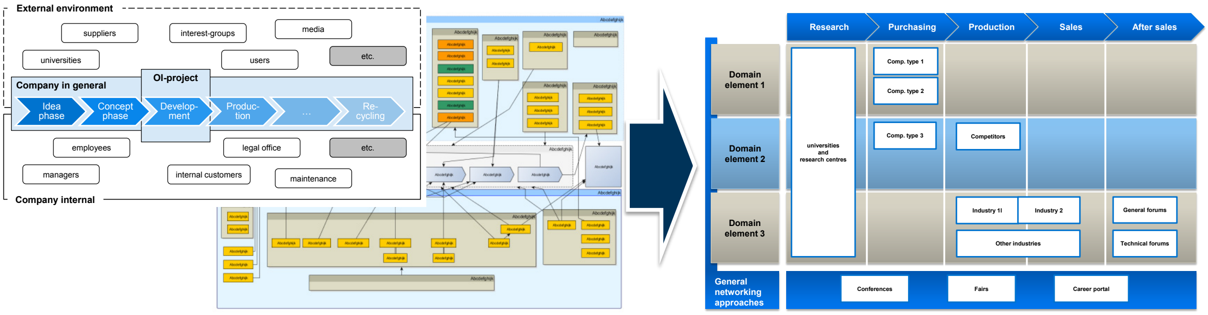

Figure 5. OI-actors identification map and derived search field matrix

Within **step 2** (*Identification of new potential OI-actors*), we chose the path of an active searching. Due to need of high secrecy, the company wanted to keep full control over the search process. Besides others, we selected *Searching* and *Pyramiding* for the actor search.
Searching was conducted offline at a trade fair. The main reasons for this choice and adaption were the missing preconditions in terms of infrastructure, existing communities, etc., small effort for learning the search method, a high degree of control by the OI-team and the possibility to gain an overview of the topic in general and potentially aspects which were not in the main focus. The effort for preparations was medium. It mainly included the setup of the questionnaire for interviewing companies at the trade fair as well as the definition of a suitable "story" for the incognito search as well as search attributes. These attributes were an important success factor since they should be narrow enough for filtering suitable OI-actors but being broad enough to allow the identification of OI-actors outside the usual solution space (e.g. with alternative new production technologies).
As second search method, *Pyramiding* with an academic research institute was chosen. By this, the institute's expertise and existing knowledge about potential OI-actors could be used. This allowed an initial assessment of OI-actors as well as a focussed identification of potential OI-actors from a specific search field. The effort for learning the search method was medium. The main challenge was the formulation of the search task. In comparison to the fair trade, the communication was more open due to a personal and trustful relationship to the institute. However, the constraints of questions and of answering returning questions were high. The resulting list of potential OI-actors was shorter but of a higher perceived quality than the results from the fair trade. Afterwards more information of the potential OI-actors was gained in the internet. By this, also an online *Pyramiding* was conducted by

analysing cooperation to academia and industry, which were mentioned on the companies' websites. Besides, we also used search engines including the companies' names, "cooperation"/"Kooperation", "project"/"Projekt" as search terms. At this, the main challenge was the limited access to reliable data.
The identified potential OI-actors were then assessed in **step 3** (*Assessment of OI-actors*). To support an efficient process, after each search they were assessed regarding KO-attributes. This allowed purposeful search iterations. For instance, since the amount of potential OI-actors was not sufficient after the fair trade, *Pyramiding* was conducted. In the context of this industry case, potentially more iterations than necessary were conducted due to the focus on testing different search methods and adaptions. In the end, ca. 180 potential OI-actors were identified. Ca. a quarter of them fulfilled all four KO-attributes. All potential OI-actors were structured and depicted within a table to allow a systematic overview, as shown in Figure 6. The clustering dimensions were the type of actors (industry, academia) and the geographical location (Germany, Europe, International) due to the regarding effort of traveling and differing legal regulations. For a better graphical differentiation, we used a traffic light notation for all KO-attributes: while green shows fulfilled and red unfulfilled KO-attributes, yellow indicates attributes, which could not be assessed due to missing data.

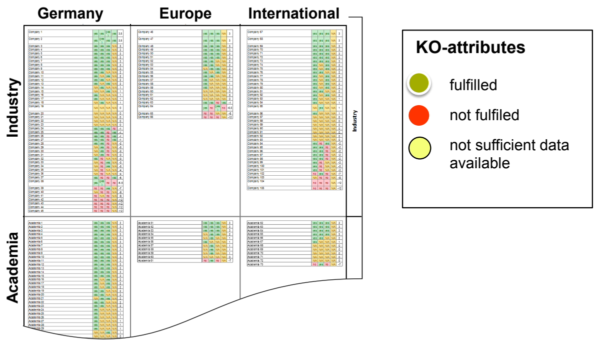

Figure 6. Identified and clustered potential OI-actors

Since the industry case study focussed on the identification and initial assessment of new potential OI-actors the following steps of the search methodology have not been conducted.

6 DISCUSSION

Based on the experience of the evaluation, the presented search methodology offers valuable guidance for planning and conducting an OI-actor search. The analysis of the current state of existing SH and the definition of required OI-actor attributes supports companies to reflect where important dependencies exist as well as to make implicit knowledge of single persons explicitly useable by the entire OI-team. The process structure with different steps supports a stepwise application as well as a targeted start in later steps if some steps were already conducted in another project. The OI-actors search map was perceived as valuable by the company due to offering a graphical tool and structuring the SH identification by combining different search direction from literature and offering generic SH groups as a starting point. However, maintaining comprehensibility despite a large number of SH and dependencies is a serious challenge, we try to solve by a software tool. The search field matrix supports a purposeful and systematic search. The structuring in single fields also allows the distribution to different members of the OI-team and parallel searches. However, selecting suitable dimensions for the search field matrix is challenging especially with low experienced OI-teams.
The search method profiles proved to support the selection of useful search methods. However, as it was an initial evaluation, in future industry projects we need to analyse if some characteristics should be modified, added or removed. So far, the matching between OI-situation and search methods is done manually. For a better support, a direct mapping and tool-based semi-automated ranking considering specific criteria weights is necessary to support the OI-team.
Besides, the industry case showed three main challenges, which are also relevant for other OI-projects:

- **Large amount of identified OI-actors**: though contrary concerns in the beginning, in the end the amount of potential OI-actors was relatively large. Hence, a detailed analysis of all OI-actors was not possible due to the resulting high effort. At this, the suggested step-wise assessment approach, starting with KO-attributes, proved to be promising.

- **Limited access to information about actors**: it increases (1) the assessment effort and (2) the risk of missing suitable OI-actors due to a lack of information. The use of easily assessable KO-attributes in the case study only considered the first aspect. The risk of missing suitable OI-actors needs to be addressed in our following research in more detail.
- **Definition of SH attributes**: is challenging since (1) a too specific definition can cause a too small pool of potential OI-actors and missing valuable OI-actors outside the search focus (e.g. cross-industry experts), while (2) a too broad definition can result in a non-manageable multitude of OI-actors. (3) The number of attributes itself is challenging due to the resulting assessment effort. At this, the KANO-approach and a limit to ca. 10 attributes seems promising.

Though the case study proofed the general applicability and benefits of the presented methodology for identifying and ranking OI-actors, it was strongly supervised and conducted by us as researchers. The goal of an autonomous applicability by industry teams is not fully proven so far. Hence, in two recently started industry projects we need to further evaluate the autonomous application and compare the industry results with our results gained by a parallel methodology application at the institute.

7 CONCLUSION AND OUTLOOK

This paper presents a methodology, which supports an academic or industry team by planning OI-projects in terms of identifying and assessing suitable OI-actors. The methodology offers guidance by analysing existing stakeholders (SH) and deriving search fields for a targeted search of potential OI-actors. The method profiles include relevant characteristics of each method and support the choice of suitable search methods. The methodology's structuring in different steps supports the conduction and orientation within the methodology. It also allows the targeted start in specific (later) steps if some data is already available, e.g. from earlier OI-projects. It also allows purposeful iterations if partial results are not sufficient.

The contribution for academia and industry is the integrated and explicit character of methodical guidance when planning an OI-project. Instead of abstract descriptions or widely spread partial information, the presented search methodology offers a holistic stepwise approach supporting especially OI-teams without extensive experience in OI. This reduces the risk of a project's failure due to missing relevant OI-actors. The graphical depiction of contained methods, such as OI-actor identification map and search field matrix, supports their comprehensibility and usability for industry.

The next steps within the presented industry case are a detailed analysis of the pre-filtered OI-actors by the industry partner, contacting of relevant OI-actors and a resulting cooperation. Especially the results and experience of this cooperation are of interest since they allow a retrospective evaluation if the actual OI-project performance of the selected OI-actors fits to their previous assessment.

Besides, due to the initial character of the search methodology it needs to be further evaluated in future OI-projects. Potential points for improvement are a more detailed support for the SH analysis, defining OI-actor attributes and defining suitable dimensions for the search field matrix. At this, literature analysing OI-intermediary cooperation might provide valuable further insights. The search method profiles need to be enhanced (e.g. in terms of a semi-automated mapping and selection tool) and evaluated regarding their integrity and support.

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