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Identifying Open Innovation partners: a case study in plant manufacturing

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Abstract: By opening a company's innovation process and allowing purposeful collaboration with external partners, Open Innovation (OI) offers different advantages, such as the use of external expertise, shorter time-to-market and reduced failure rates. However, the success of OI is directly linked to the selection of the "right" partners, i.e. who operatively contributes to a project's solution or ensures the strategic project's success. Despite this relevance of OI-partner selection, methodical support is limited hitherto – it is either too abstract or too focused on single aspects. This paper presents a methodical approach to close this gap by combining identification and selection approaches from different fields, such as stakeholder analysis, lead-user identification and systems engineering. The methodology was evaluated in an industrial OI-project with an SME from plant manufacturing. To increase the methodology's usability, we implemented and initially evaluated a software prototype within the OI-project.

Keywords: Decision making, German Mittelstand SME; Open Innovation; Open Innovation partners; partner choice; project planning.

1 Introduction

Open Innovation (OI) describes the opening of a company's innovation process to its environment (Chesbrough 2003b). Innovations are developed by collaborating with different external partners such as customers, consumers, suppliers or universities (Dahlander and Gann 2010, Chesbrough et al. 2014). The utilization of external and internal knowledge, expertise and creativity can e.g. increase the innovativeness of products, products' market fit or reduce time to market (Braun 2012). For the success of OI, the selection of appropriate OI-partners is essential (Huizingh 2010) – depending on the specific project's issue, the required expertise or context factors such as the confidentiality of knowledge and project results. Mistakes in this stage might endanger the success of an entire OI-project since they are linked to various risks and barriers of OI, such as knowledge drain or the Not-Invented-Here-Syndrome (Gassmann et al. 2010b, Braun 2012). Nevertheless, selecting suitable OI-partners is still a major challenge for academia and companies when planning an OI-project (Huizingh 2010, Guertler et al. 2014, Hossain 2015). Companies face the risks of involving less suitable partners, missing relevant partners and neglecting important dependencies between single partners or stakeholders. Underlying reasons may be missing systematics of searching for potential OI-partners and assessing their relevance. Notwithstanding the need for a systematic OI-partner search, adequate methodical support for identifying and selecting relevant OI-partners (both individuals and groups) is still limited. Often it is too abstract for industrial use or focused on particular forms of OI, such as crowdsourcing (Piller and Ihl 2009).
Up to now, companies – especially if they have no or only little experience with OI – tend to apply OI by a trial-and-error approach or commission external consultancies for planning an OI-project (Gassmann et al. 2010a, Huizingh 2010). A common shortcoming of selecting OI-partners is focusing only on "technical" or operative partner-criteria, such as experience, expertise and competences (Guertler et al. 2014). Strategic partner-criteria are often neglected, such as a differentiation of buyers and users or external and company-internal decision makers. Additionally, OI-teams (who are planning and managing the OI-project) tend to focus on external OI-partners and neglect internal stakeholders. This may mean an unused pool of knowledge or even cause OI-barriers like the Not-Invented-Here-Syndrome (Enkel 2009, Grosse Kathoefer and Leker 2012).
Single OI-methods comprise specific selection methods such as the Lead-User approach, which aims at identifying partners with specific expertise (von Hippel et al. 2009) but neglects the strategic perspective. However, there exist other, not OI-related approaches for selecting partners, which are well established in other disciplines. One approach from project

management is stakeholder analysis (Mitchell et al. 1997, Bryson 2004, Freeman 2010), which allows managing and balancing various potential interest groups. It bears great potential benefits for OI (Gould, 2012) by considering strategic partner-criteria such as interests and power (Mitchell et al. 1997), but lacks a "technical" or operational perspective of the partners' expertise and competences.

Our research combines elements and the advantages of both approaches as well as enhances it by further elements to derive a holistic approach for identifying and selecting relevant partners of an OI-project. Our research aims at combining the advantages of the operative-"technical" perspective of Lead-User identification, the strategic-political perspective of stakeholder analysis and stakeholder interdependencies perspective of systems engineering. To support companies planning OI-projects and to support academia better understanding the success factors of an OI-project, the resulting research questions of this paper are:

How can relevant OI-partners be identified? How can the project's relevance of potential OI-partners be assessed? Which success factors influence the application of a partner selection approach in industry?

Based on a first integrated OI-partner selection approach (Guertler et al. 2015), this paper presents an enhanced version and its evaluation by an industrial OI case study in the field of plant manufacturing. Our approach is developed and evaluated in the context of a two-year research project with three German Small and Medium Enterprises (SME) from machine and plant engineering. Based on a literature review, we derive a requirement list for OI-partner selection, which is evaluated by a requirement analysis workshop with the industry partners. The requirements serve as basis for analysing the OI-specific strengths and weaknesses of different partner selection approaches from the field of stakeholder analysis, Lead-User identification, patent analysis, systems engineering and other OI-related approaches. By adapting and combing suitable elements from these approaches and enhancing them by new elements, we develop an integrated OI-specific approach for selecting OI-partners. To allow a better use and avoid a loss of data, we develop a first software prototype implementation of our approach.

2 Theoretical background

Open Innovation

Open Innovation (OI) was first introduced by (Chesbrough 2003a, Chesbrough 2003b) and describes the opening of a company's innovation process to its environment to allow purposeful knowledge exchange with external partners such as suppliers, universities, customers and users (Dahlander and Gann 2010, Chesbrough and Bogers 2014). At this, the equivalence of internal and external knowledge is a basic aspect of OI (Chesbrough et al. 2006). OI itself is not an entirely new concept (Chesbrough 2003b, Enkel 2009, Huizingh 2010) but is based on other concepts from innovation management or systems engineering. However, a new aspect of OI is the additional consideration of un-/specific crowds of users and consumers, and internationally distributed partners, besides dyadic cooperation and 'classical' partners, such as suppliers (Möslein and Neyer 2009, West et al. 2014). The utilisation of external expertise and knowledge offers various benefits to companies, such as faster development times and better market fits of products (Braun 2012). Nevertheless, OI also comes along with increased and new challenges and risks like knowledge drain or focussing on wrong external partners (Enkel 2009, Braun 2012). Within this paper, we focus on the relevance of a sufficient planning of the OI-project and selecting suitable OI-partners. As Guertler et al. (2014) showed, a holistic assessment is crucial when selecting OI-partners, i.e. an operative-technical perspective for their knowhow and competences as well as a strategic-political perspective for their influence on the OI-project's success.

Searching for project partners

For the operative-technical perspective of partner search, an established method is the Lead-User approach (von Hippel 1986, von Hippel 2005). By definition, Lead-User face specific needs long before the majority of users does. Besides, they also have the motivation and knowhow to support companies developing a (technical) solution to fulfil their needs (von Hippel 2005). Hence, a central aspect of the Lead-User approach are methods for identifying those Lead-Users by assessing the needs and knowhow of users. Typical Lead-User identification methods are e.g. Screening (von Hippel et al. 2006), Pyramiding (von Hippel et al. 2009), Netnography (Belz and Baumbach 2010) and Broadcast Search (Diener and Piller 2010).

An established approach focussing on the strategic-political perspective of project partners is stakeholder analysis (Freeman 2010). It supports identifying all individual, groups and organisations, which might influence or might get influenced by a project (Freeman 2010, p.25). These are subsequently analysed e.g. regarding their power, interests, attitudes and legitimacy (Mitchell et al. 1997, Bryson 2004). In addition, their dependencies to each other can be analysed too, e.g. by using approaches from network theory or complexity management (Maurer and Lindemann 2007).

Situative Open Innovation

To address industry needs and resulting research gaps identified by Guertler et al. (2014), we developed the *Situative Open Innovation (SOI)* methodology (Guertler et al. 2015). "*Situative*" stresses the crucial fact that each OI-project needs to be adapted to the specific project's and company's context to be successful (Dahlander and Gann 2010, Huizingh 2010). SOI supports OI-teams from academia and industry (1) analysing the OI-goal as well as the company-internal and -external OI-context, (2) the search for suitable OI-partners as focused in this paper, (3) the subsequent selection and adaption of suitable OI-methods, and (4) the planning of project controlling and risk management (see Figure 1). The phases (1) to (4) represent rough project planning, which gets detailed in phase (5), i.e. by defining the specific start of a workshop or the acquisition of a service provider of an ideation platform.

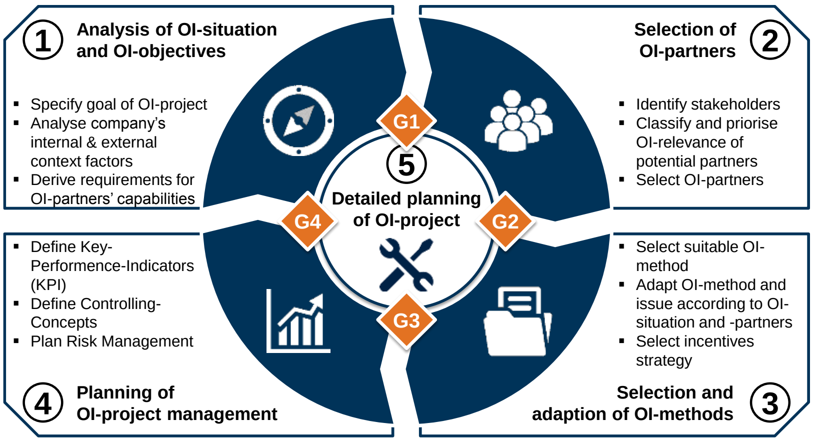

Figure 1 Situative Open Innovation – a methodology for planning OI-projects (Guertler et al. 2015)

3 Methodology for identifying suitable partners for an OI- project

Overall partner search methodology

The search for suitable OI-partners in the second phase of Situative Open Innovation (SOI) can be subdivided into a sub-approach containing six steps, as depicted in Figure 2 (Guertler et al. 2015). It uses the results of the context ("*situation*") analysis and specified OI-project goals from the first phase of SOI. On this basis, partner-criteria for the search and assessment of potential OI-partners are derived. An initial assessment of known stakeholders allows both an evaluation if new further OI-partners are required and to derive search-fields. Based on a following more detailed assessment of potential OI-partners, they are ranked to allow the selection of relevant ones.

The OI-partner search approach is modular, adaptive and scalable, i.e. companies can e.g. remove or add steps, enhance them by new methods, and reduce or increase the scope of search. Central decision points of the methodology are highlighted as gates (G.2.1 – G.2.3). A more detailed description of the methodology is given in the following.

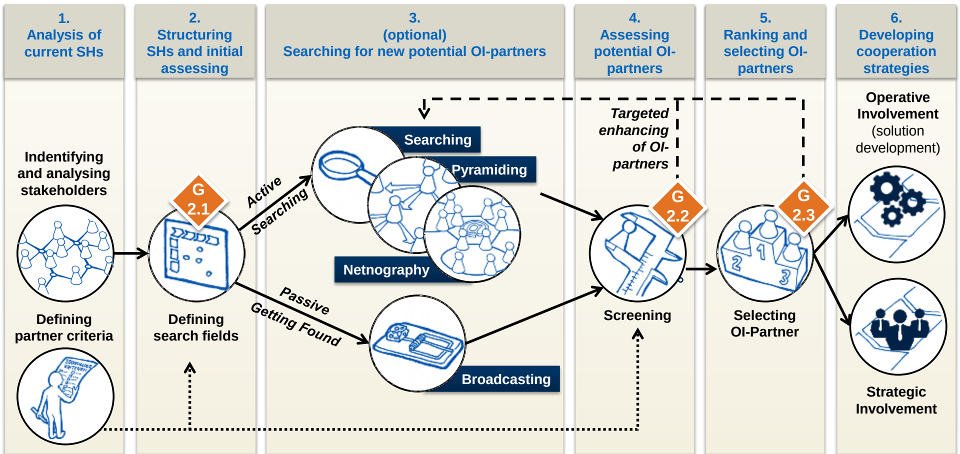

Figure 2 Integrated methodology for identifying Open Innovation partners (Guertler et al. 2015)

Software prototype

To increase the methodology's usability as well as data handling and documentation, we implemented it as a software prototype. It was developed within the software platform "*Soley*" (www.soley-technology.com), an institute's spin-off. Soley is a graph-based big-data analysis system, which allows collecting, processing and analysing distributed data and knowledge within a company. Comparable to smart-phone apps, data processing and analysis algorithms can be bundled in workflows and modelling-packages, which can be specified to the particular application contexts and tasks. Since the software prototype was developed in parallel to the OI-projects with our industry partners, we could only evaluate some of its functionalities so far.

Figure 3 illustrates the standard view of the OI-partner search package in Soley. Within the modelling window (1), stakeholders and their dependencies are modelled by using specifically defined modelling elements (2). They can be characterised in detail by element properties (3). All analysis methods and algorithms are implemented in so-called workflows, which can be started via the workflow launcher (4). Their order reflects the process order of the OI-partner search methodology. The smart selector (5) supports the depiction of analysis results by allowing the targeted selection and manipulation of elements, e.g. hiding of weak stakeholder dependencies to focus on strong dependencies.

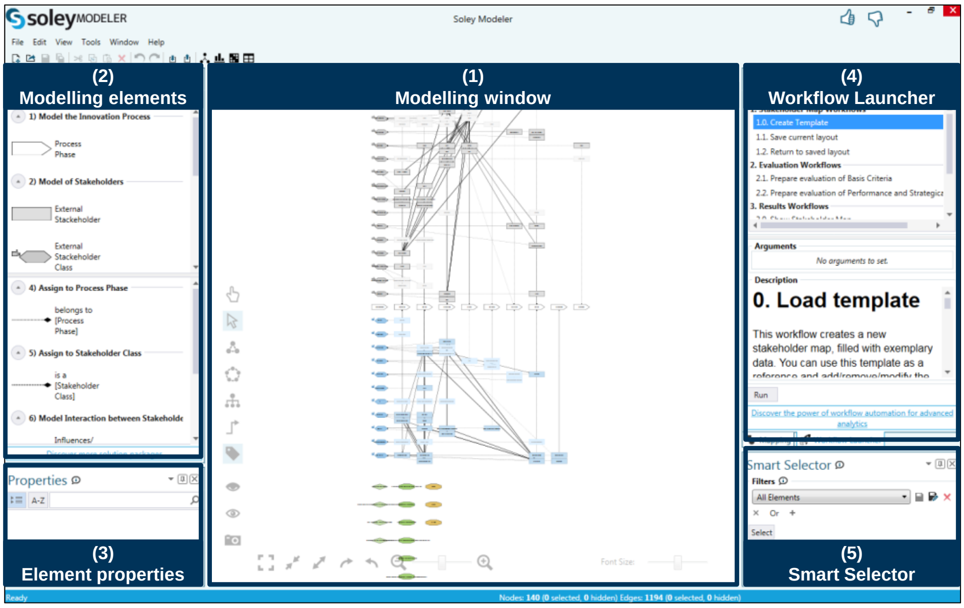

Figure 3 Standard view of OI-partner search package in Soley

Detailed description of partner search methodology

In the following, we give a detailed overview of the single steps of the OI-partner search methodology, as introduced in Figure 2.

(1) Analysis of current stakeholders

First operative-technical and strategic-political partner-criteria are defined based on the analysis of the OI-goal in the first phase of SOI (see Figure 1). Operative-technical criteria specify expertise, knowhow and competences of OI-partners, which are required to contribute to a solution of the OI-goal. They are clustered according to a simplified version of KANO (Matzler and Hinterhuber 1998) to allow an efficient later assessment of potential OI-partners: (a) **basic criteria** (“must-have”), which state the principal usability of an OI-partner; (b) **performance criteria** (“should-have”) for a detailed assessment; and optional (c) **excitement criteria** (“nice-to-have”) for differentiating between similar ranked OI-partners. Strategic-political criteria assess the strategic

relevance of stakeholders regarding their influence on the success of an OI-project. They are derived from stakeholder literature, such as power, interests and attitude (Mitchell et al. 1997, Bryson 2004).
Within this step, also known stakeholders of the project and company are identified and analysed. In the context of a workshop, the inter-disciplinary OI-team identifies stakeholders and their dependencies. To support this task, we propose the stakeholder-map shown in Figure 4. The given structure of internal and external stakeholders, innovation process phases and generic stakeholder-classes support especially unexperienced OI-teams. If relevant given stakeholder-classes can be detailed by identifying regarding stakeholders, or deleted if irrelevant. The goal is a holistic collection of stakeholders to reduce the risk of missing important stakeholders or dependencies between stakeholders.

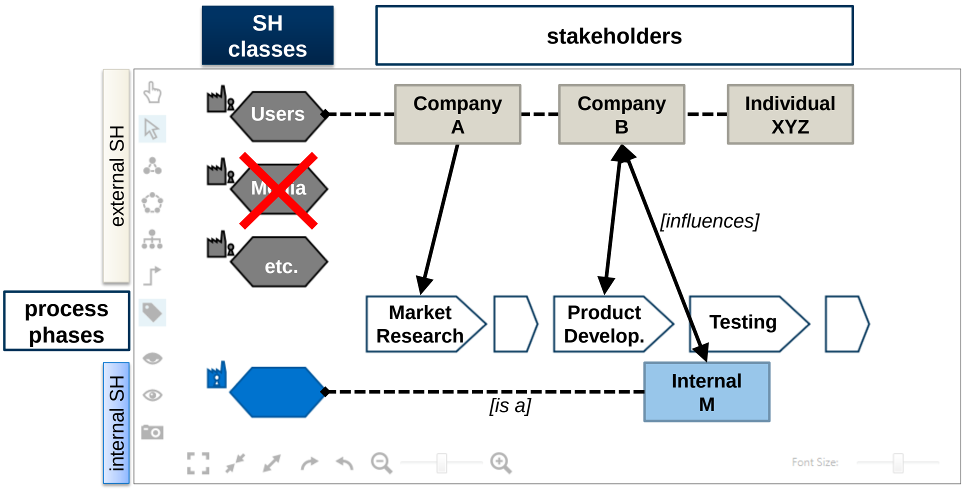

Figure 4 Stakeholder map for identifying known stakeholders of project and company (Guertler et al. 2015)

(2) Structuring SHs and initial assessing
The following step contains an initial assessment of known stakeholders regarding the partner-criteria to evaluate the need of a further search for new potential OI-partners. Stakeholders are structured in a Search-Field-Matrix, depicted in Figure 5. The x-dimension contains the process-phases of the stakeholder-map while the y-dimension contains the partner-criteria. Stakeholders are mapped to the regarding fields if they fulfil the partner-criteria. This allows an overview where the OI-team knows already enough potential OI-partners and where potentially new further OI-partners might be necessary. Especially “white” empty fields are interesting as potential search fields.

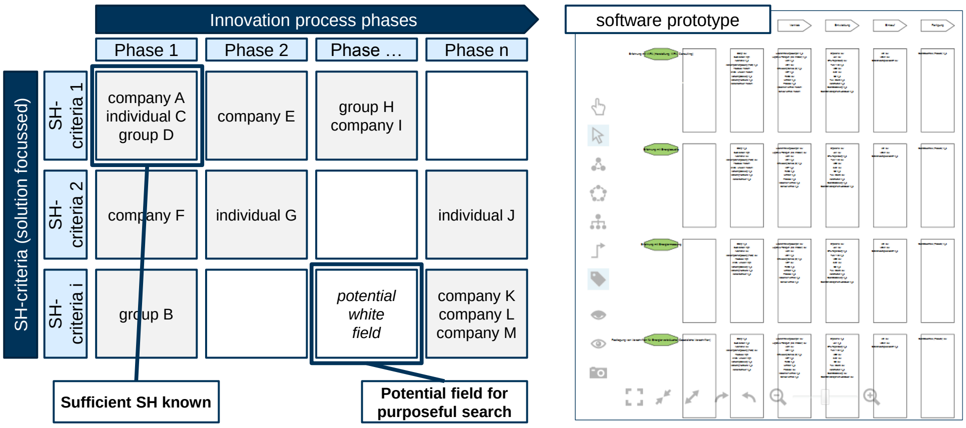

Figure 5 Search-Field-Matrix for identifying and structuring partner search areas (Guertler et al. 2015)

(3) Searching for new potential OI-partners

Within the defined search fields, the OI-team subsequently searches for new potential OI-partners. To allow an efficient search, search method profiles summarise relevant characteristics of each search method, as illustrated in Figure 6. This allows a discursive selection within the OI-team.

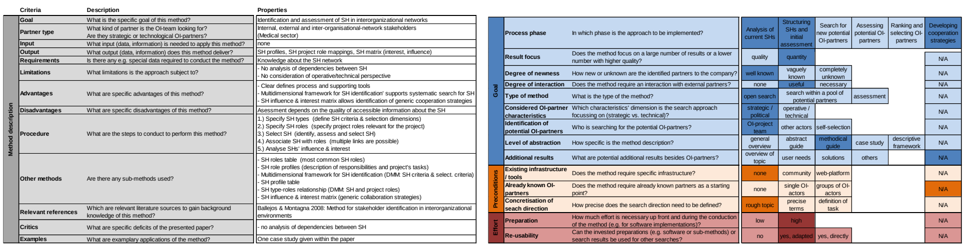

Figure 6 Search-method profiles for identifying new potential OI-partners

(4) Assessing potential OI-partners

Using the results of the initial assessment, all identified stakeholders and new potential OI-partners are assessed. To reduce the assessment effort, the operative-technical criteria are assess by a step-wise approach starting with basic criteria and filtering all potential OI-partners, who do not fulfil them. Only the remaining ones are assessed regarding the performance criteria. Strategic criteria are assessed for all stakeholders to avoid missing relevant ones, who might risk the success of the OI-project.

(5) Ranking and selecting OI-partners

The assessed stakeholders are ranked regarding their OI-project relevance. To support a profound selection, different rankings are considered, which allow different perspectives on the OI-partners' relevance, as depicted in Figure 7:

- **Strategic-Operative-Portfolio** (Guertler 2014):
  Ranking stakeholders regarding their (a) operative-technical potential of contributing to a solution of the OI-goal, and (b) their strategic-political relevance for the OI-project's success.
- **Influence-Portfolio** (Lindemann 2009):
  Ranking stakeholders regarding the (a) number of stakeholders they influence, (b) the number of stakeholder who influence themselves, and (c) their resulting activity and criticality.
- **Power-Attitude-Portfolio** (Bryson 2004):
  Ranking stakeholders regarding (a) their power, and (b) their attitude (support, opposition) towards the OI-project

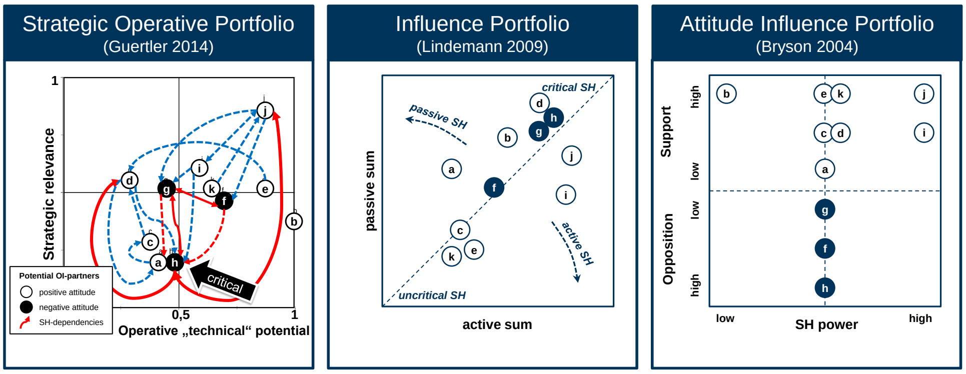

Figure 7 Overview of different ranking portfolios of potential OI-partners

(6) Developing cooperation strategies

The previous portfolio rankings can also be used to derive generic cooperation strategies. For instance, the Strategic-Operative-Portfolio allows the differentiation in a direct operative involvement (by contributing to the project's issue), an indirect strategic involvement (e.g. by informing) and a non-involvement, as shown in Figure 8. The specific collaboration strategies are defined in a following step of SOI.

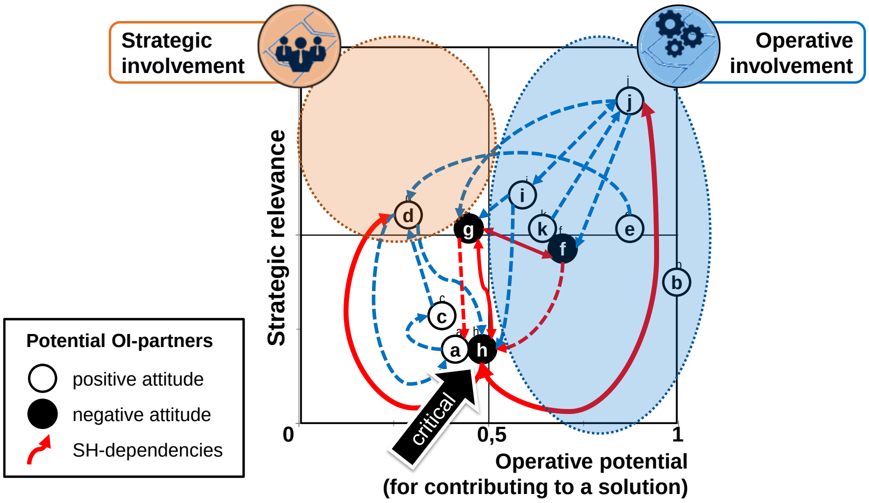

Figure 8 Using the Strategic-Operative-Portfolio to derive generic cooperation strategies

4 Case study-based evaluation in plant manufacturing

Due to confidentiality reasons, we need to make a compromise between a detailed as possible and an abstract as necessary description of the following methodology's evaluation in industry.

The regarding company was a German Mittelstand SME designing and manufacturing production plants and corresponding services for packaging products. Its goal for the OI-project was the development of a new service model, which should be offered both as a supplement for existing production machines on the market (own and machines of competitors) as well as future production machines as integrated product service system. Since this type of service was new for this industry branch, the existing experience in the company and branch was limited. The strength of competitors was medium, which resulted in a medium need of concealment, i.e. external actors should not know about project results but could know about the existence and goal of the OI-project. The OI-team consisted of a senior innovation manager, who also served as a project manager, a specialist of the service respectively the sales department.

In the beginning, the OI-team got an introduction into the OI-partner selection approach and regarding methods and tools, which the OI-team autonomously applied in the following. In the case of questions, the OI-team could contact our research team and ask for clarification or support. These questions and general feedback as well as the results of the different planning stages were used to evaluate the applicability and benefits of the OI-partner selection approach as well as points for further improvement.

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Application of partner identification methodology

The definition of SH-criteria as well as the identification and first SH analysis steps were conducted within a workshop with the OI-team of the industry partner. In the workshop, we used a flipchart-based SH-map, which we then transferred to Soley and send to the OI-team for evaluation and detailed analysis of SH-dependencies. The workshop's discussion of the interdisciplinary OI-team proved to be fruitful since each member had a slightly different perspective and base of knowledge. In sum, they identified 11 process phases, 27 SH-classes and 90 SH as well as four operative basic partner-criteria and six technical performance partner-criteria.

The initial assessment of SH regarding the partner-criteria was conducted in MS Excel as well as the derivation of search fields, and subsequently transferred to the Soley software prototype. By this, 42 SH were filtered, who did not fulfil all basic partner-criteria. The search-field-matrix revealed that there were at least two SH in each field. Thus, the OI-team decided to skip the search for new, further OI-partners to speed up the OI-project. Nevertheless, for research issues we decided to conduct this search by ourselves. The regarded search-fields were actors and rules setting the legal and organisational frame of the new service as well as actors from other industries, which had already experience in their branch within particular aspects of the OI-goal.

The search for regulators and rules or norms was conducted using a web-based pyramiding search, starting with searching for the partner-criteria. The search for OI-partners in other industries was orientated at cross-industry-searches, such as (Echterhoff 2014). Since the search-field was addressing energy issues, we started by identifying the industry branches with the highest energy consumption and industry branches with experience in reducing energy consumption. Another approach was using the similarity of the production process by identifying industry branches with continuous flow-production – ranging from close ones with similar processed materials, via automotive production to filling plants and food production. Within these industry branches, we subsequently searched for potentially experienced individual experts, companies and groups. The resulting list was given to our industry partner, who internally assessed potential new OI-partners. Due to the lack of reliable information about the new potential OI-partners, their assessment was conducted discursively with company-internal experts from different departments.

Based on the assessment of known SH and new potential OI-partners, a Strategic-Operative-Portfolio was derived. From this, the OI-team picked ca. 10 OI-partners, who can roughly be grouped in customers and cross-industry manufacturers. Unfortunately, an initially identified and then selected social media group turned out to be only temporary and did not exist anymore at the time of OI-partner selection. Due to the low number of OI-partners and specificity of topic, the OI-team decided to use a workshop to analyse internal and external motives of their customers to use the planned new service as well as discussion existing service models from other (non-competitive) industry branches.

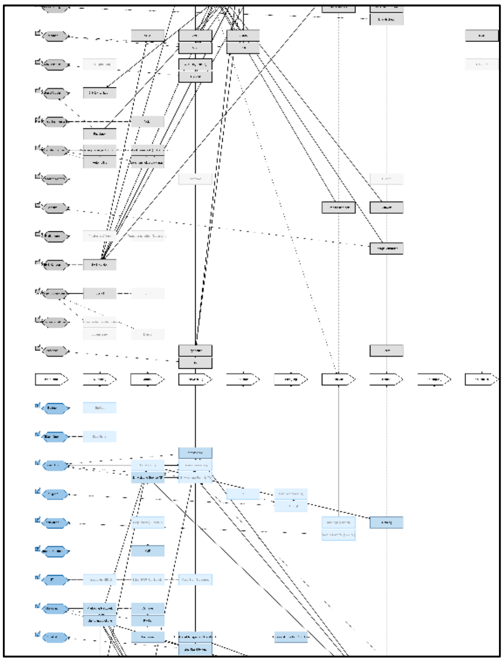

Figure 9 Anonymised overview of stakeholder map from industry case study

5 Discussion

The case study evaluation of our OI-specific partner selection approach proves its applicability and benefits in general and for the specific challenges of the regarding industry project in particular. Due to the development of a new service model for existing and future production machines, stakeholders of the new service as well as of the machine and users of competitors' machines need to be considered. At this, the systematic stakeholder analysis at the beginning proves to be valuable to identify different external and internal stakeholder-groups as well as their dependencies. The stakeholder analysis also ensures a homogenous knowledge level within the OI-team, since it consisted of members from different departments and of different employment times. The initial assessment of stakeholders allows an evaluation if the already known stakeholders are sufficient as potential OI-partners or if a search for new

OI-partners is required. By the coupling with a search-field matrix, defined areas for an OI-partner search can be derived and delegated to different OI-team members. The step-wise assessment of potential OI-partners firstly using “must-have” basic and subsequently “should-have” performance criteria allows a reduction of the regarding assessment effort. The assessment results are depicted in a strategic-technical stakeholder portfolio. It supports the selection of relevant OI-partners by visualizing their operative-technical expertise for an operative involvement into a solution development as well as their strategic-political relevance for the OI-project’s success.

Despite the positive evaluation results, there also occurred a couple of challenges during the evaluation. The main challenge was a switch of the company’s OI-project manager (after selecting the OI-partners) due to an insufficient project hand-over to his successor in terms of goal and expectations of the OI-project as well as its current state and made decisions. At this, the inherent documentation of the methodology proved to be beneficial by providing information of progress and made decisions of the OI-project. Another challenge was a general impatience regarding method application and corresponding results. Based on this, we elaborated on the modular setup of the methodology to allow a better scaling and adapting, e.g. supporting the initial assessment if searching for new OI-partners is necessary or not. However, the new OI-project manager criticized a “missing newness and innovativeness” of the selected OI-partners, especially those of customers. Though they were selected based on the assessment criteria and decision of his predecessor, and though we also believe that customers play a crucial role and should not be left out in such an OI-project, we need to critically discuss if this is an issue we need to address by alternative search and assessment approaches in future research. In general, the assessment remains one of the main challenges of selecting OI-partners in terms of effort and accessibility of (reliable) information.

Due to the parallel development of the software prototype, another critic was the high effort of transferring data from one software system to another, which also sometimes included redundant assessment activities. This issue will be solved by a consistent software prototype, including all functionalities of the methodology. The evaluation of single functionalities were promising but need to be evaluated in interaction with the other functionalities in a following OI-project.

Regarding planning success factors, in line with authors such as Karlsen (2002), the evaluation showed the relevance of interdisciplinary OI-teams for identifying and analysing stakeholders due to their different backgrounds and knowledge bases. Nevertheless, open discussions within

the OI-teams are crucial to ensure a homogeneous knowledge level, which is important for the following OI-project.
The evaluation also showed that it is important to clearly state efforts, benefits and regarding timeframes of a methodology to ensure its application in companies. While academia tends to focus more on benefits of a methodology and often neglecting the necessary effort, companies tend to focus primarily on costs. Thus, a positive cost-benefit ratio needs to be proven for each activity.
Besides the utilisation of software tools to reduce data handling efforts, the evaluation showed the need of tailorable methodologies, which companies can adapt and scale according to their specific needs.
The evaluation also stressed that companies prefer a methodology supporting their decisions but not taking their decisions. This results in the need of a transparent process and bases of decisions as well as their documentation. Besides project hand-overs, this is also important for possible justification issues towards superiors or others.
Indicating possible links between methodology and company's structures, such as processes and databases, also increases its application. This might include existing sources for input data to reduce the methodology's effort as well as additional fields of application of methodology's results to increase its benefits.
In general, the evaluation confirmed the need for a certain amount of self-assertion of academic teams to break daily routine and old patterns of thinking in companies to allow new approaches and methodologies.

6 Conclusion and outlook

Despite the relevance of selecting sufficient OI-partners for an OI-project, methodical support is limited so far. This paper presents an OI-specific approach to close this gap. It combines different approaches, which are well established in their fields, i.e. stakeholder analysis, Lead-User identification and systems engineering. To improve its usability the methodology was also implemented as software prototype, which was initially evaluated too.
Other researchers can use the integrated approach for developing own partner selection approaches. It provides indications how different approaches can be combined to one holistic methodology. In addition, the case study also reveals which potential success factors and barriers are essential for an industrial application of such approaches. This supports academia when collaborating with companies and especially when developing methods and tools for an application in companies. It helps reducing the risk of "typical" mistakes. In general, the methodology and

its evaluation contribute to a better understanding of (open) innovation activities in companies.

Our methodology supports OI-teams from industry and academia when planning an OI-project by identifying existing stakeholders, evaluating the need for further partner searches, deriving defined search-fields, efficiently assessing potential OI-partners and supporting the selection of OI-partners. The modular setup of our approach allows a lean procedure, which OI-teams can adapt and scale according to the goal and boundary factors of their OI-project. By this, it ensures the identification and involvement of appropriate OI-partners as well as prevents neglecting important stakeholders. By its systematic character and inherent documentation of process steps, the methodology allows a profound selection of OI-partners. Overall, our goal is a methodical guideline, which companies can use autonomously. In addition, the approach also enables companies to better understand and evaluate offers by external service providers and consultancies. The discursive workshop elements support a homogenous knowledge level within the interdisciplinary OI-teams.

Within our following research, we need to address the issue of effort of assessing OI-partners and accessibility of (reliable) information about them – especially when assessing larger groups of SH and potential OI-partners. The software prototype and interaction of its functionalities will be evaluated in another OI-project with a SME industry partner producing household applications. To increase the methodology's usability in industry, it is also necessary to further clarify which input data already exists where in the company, and which additional fields of application for output data exist within the company, e.g. data from the stakeholder map.

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