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Technology Scouting – a case study on the Deutsche Telekom Laboratories

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Abstract: Technology Intelligence has become an important field of study in which a variety of different methods are discussed, all aiming at identifying opportunities and threats arising from advances in technology. In this respect, Technology Scouting is a method which can lower the time lag between the advances in technology and their detection by methods such as patent or publication analysis. Furthermore, in an environment of increasing technological complexity and the globalization of R&D, the successful identification and usage of external sources of knowledge is becoming increasingly important. In the sourcing of technology the scouts can also play an important role in identifying valuable sources and facilitate the sourcing.

Based on two case studies of the Deutsche Telekom and British Telecom, as well as a literature review, the paper proposes a definition of Technology Scouting, a generic process, and identifies the motivations of the actors in the process.

Keywords: technology intelligence, technological forecasting, technology foresight, technology scouting, technology exploration, strategic foresight, technology monitoring, technology scanning.

Biographical notes: René Rohrbeck is senior researcher at the Deutsche Telekom Laboratories (T-Labs) and associate researcher at Berlin Technical University's Institute for Innovation and Technology Management. At the T-Labs he also coordinates the Technology Intelligence activities. His research interests are Strategic Foresight, Technology Scouting, Roadmapping and University-Industry Collaborations. Before joining the T-Labs, Rohrbeck worked as a business development manager for a technology consultancy and spent two years as a management consultant in the automobile industry.

1 Introduction

Companies today face a variety of challenges, including rising competition, increasing volatility of markets and – as markets converge – the entry of new competitors onto their home turf. Technological competence plays an important role in maintaining or enhancing their competitive position.

One of the main elements of technological competence is the knowledge of the relevant technological developments and trends [1]. For this, it is essential to closely monitor developments in the core technologies and to scan for new technologies that have disruptive potential [2]. Methods for collecting, analyzing and disseminating such

technological information have become known as Technological Forecasting [3-6], Technology Foresight [3-5] or Technology Intelligence [7-10].

The outcome of Technology Intelligence activities is often the identification of a need to establish new competencies. Due to increasing technological complexity and the globalization of R&D it is becoming more difficult to develop all of these competencies internally. As a consequence, companies are exploring new ways of sourcing the technological capabilities externally. This sourcing of technology might be achieved by joint research, licensing, buying intellectual property rights (IPRs), creating joint-ventures or the outright acquisition of start-ups [11-13].

One method that can enhance Technology Intelligence capabilities and facilitate the sourcing of technology is Technology Scouting. The strong points of Technology Scouting are firstly its ability to detect advances in technology at an early stage. Alternative methods such as publication or patent analysis have a natural time lag of 12 to 18 months due to the publication and administrative process [8]. Secondly, the personal contact established by the scouts for information gathering purposes is a strong base for the sourcing of technology.

This paper aims to further structure the research on Technology Scouting by proposing a definition, a generic process, and by identifying the motivation of the actors in the process. These findings are based on a literature review and data drawn from two case studies of the Deutsche Telekom AG and British Telecom.

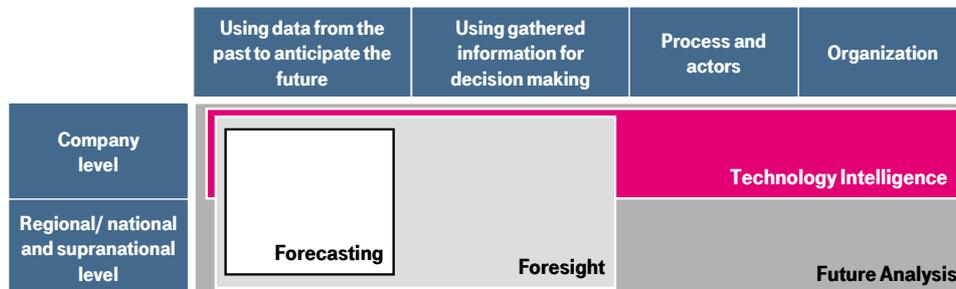
2 Defining Technology Scouting

The evolution of research in the field of Technology Intelligence

The research on the systematic search of current and future technological developments has evolved over time to include an increasing number of aspects. The identification of technological developments relies strongly on weak signals [14, 15] and aims at the detection of technological discontinuities [16, 17]. A categorization of the different research areas is shown in figure 1. In the 1970s, research on the subject was conducted under the term of *Technological Forecasting* and focused on methods for predicting the future with modeling and econometric techniques, mainly using data from the past [18]. Such methods are trend extrapolation, S-curves, trend curves and patent and publication analysis.

Technology Foresight further broadened the scope of research into the prediction of future technological developments. The new aspects were research on methods which enable networking for information gathering, assessment and interpretation, and methods which support decision making [19]. Furthermore, Technology Foresight includes the research into the capacity of organizations to cope with the future [20]. Both Technological Forecasting and Technology Foresight techniques have been investigated on a company level and on a regional, national and supranational level, such as economic areas.

Figure 1: Scientific classification of the Technology Intelligence aspect



Source: Own figure

In the 1990s, research broadened the scope of investigation to include the organization and the processes of the proposed investigation. *Technology Intelligence* [7-10] has become the dominant term to describe research focused on the company level, although the term *Competitive Technical Intelligence* has also been used in a similar sense [21-23].

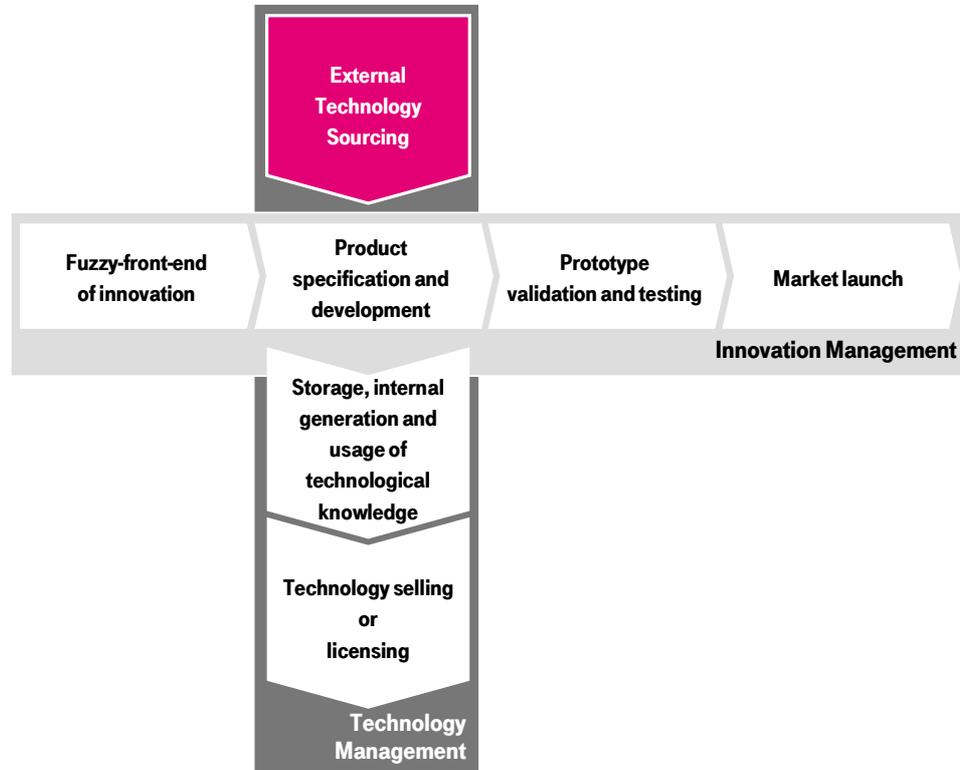
In recent years, *Future Studies* has evolved as a new term referring to research aimed at anticipating and coping with the future, including also non-technical aspects such as changes in markets, consumer needs, legislation and socio-cultural shifts [24].

The neighboring research field of Technology Sourcing

Technology Management deals with the provisioning, storage, and usage of technological knowledge [25]. It also supports the management of innovation by providing the technological capabilities for product specification and development. Figure 2 shows the interweaving of the technology and innovation management processes.

In technology management, the provisioning of the technological knowledge can be either by acquisition - which we call *Technology Sourcing* - or by internal development. In an environment of high technological complexity and volatile market needs, external technology sourcing is becoming increasingly important to ensure the competitiveness of a company.

Technological convergence and the rapid rate of technological change also make it increasingly difficult to identify the technological capabilities needed and the potential sources of technological knowledge. Different languages and regionally differing terminology have made it increasingly difficult to use data mining approaches to identify centers of expertise in specific technological areas. As a result, the usage of experts to acquire the needed technological information has become an increasingly appealing option.

Figure 2: Technology Sourcing in technology management and the innovation process

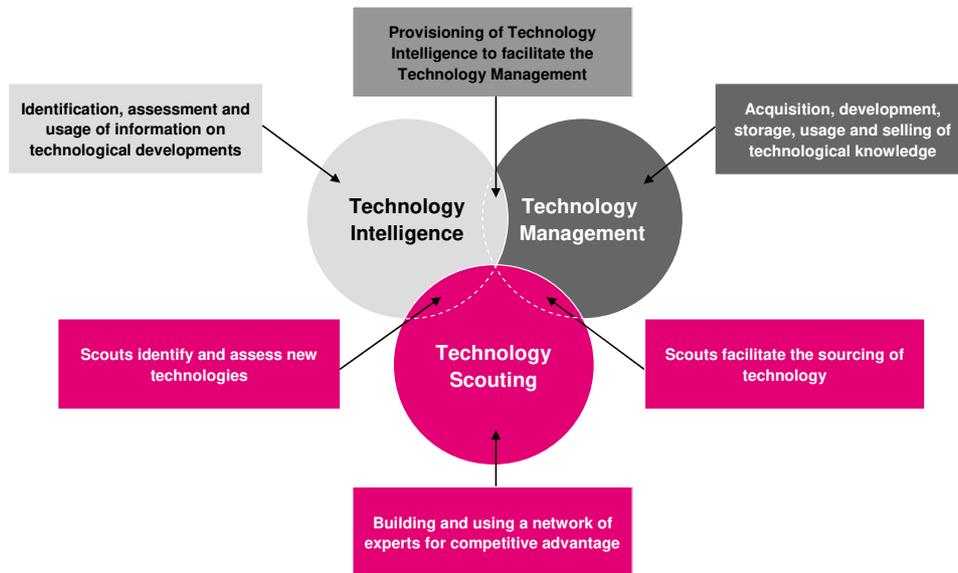
Source: Own figure following Brockhoff [25]

Definition of Technology Scouting

Technology Scouting

Technology Scouting is often seen as the logical response to the enlargement of the technological know-how market caused by the globalization of R&D. The role of Technology Scouting is twofold. Firstly, Technology Scouting identifies advances in science and technology that can be of use for the company [26]. This activity might be directed (*Technology Monitoring*), i.e., searching in specific technological fields [27] or undirected (*Technology Scanning*), i.e., searching for new technological opportunities in white spaces not yet covered by the technological scope of the company [28-30]. Secondly, Technology Scouting facilitates or executes the sourcing of technology [27, 31].

The two roles of Technology Scouting and their interweaving with Technology Intelligence and Technology Management are shown in figure 3. Other areas of interest in the research on Technology Scouting are the process, the organization and methods to build and use networks of experts.

Figure 3: The scientific classification of technology scouting

Source: Own figure

For the purposes of this paper, *Technology Scouting* is defined as a systematic approach by companies whereby they assign part of their staff or employ external consultants to gather information in the field of science and technology (S&T) and to help facilitate or execute Technology Sourcing. Technology Scouting is either directed at a specific technological area or undirected in order to identify relevant developments in technological white spaces. Technology Scouting relies on formal and informal information sources including networks of experts.

The Technology Scout

The Technology Scout is either an employee of the company or a consultant [27]. He might be assigned part or full-time to the scouting task. The desired characteristics of a technology scout are similar to the characteristics associated with the technological gatekeeper [32-36]. These characteristics include being a lateral thinker, knowledgeable in science and technology, respected inside the company, cross-disciplinary orientated, and imaginative [27].

3 The goals of Technology Scouting

In a broader sense, the goal of Technology Scouting is to gain a competitive advantage by identifying opportunities and threats arising from technological developments at an early stage and to provide the technological capabilities needed to face these challenges.

In 2004, Deutsche Telekom introduced a methodology for Technology Scouting called the “Technology Radar” [37]. The four goals of the Technology Radar approach are shown in Table 1.

Table 1: Goals of the Technology Radar of Deutsche Telekom AG

<i>Goal</i>	<i>Description</i>
Early identification...	...of technologies, technological trends and technological shocks
Raising awareness...	... of the threats and opportunities of technological development
Stimulation of innovation...	...by combining the technology reports with business potential assessment
Facilitation of the sourcing of external technologies...	...by reaching through the network of technology scouts to their sources of information

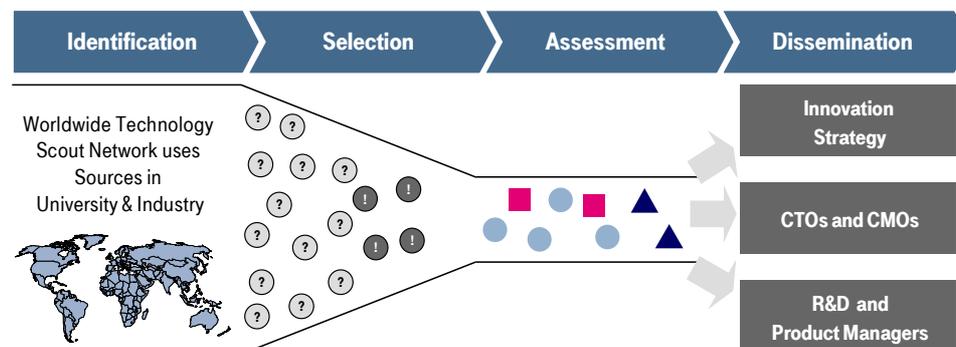
Source: Rohrbeck, Heuer, Arnold (2006) [37]

4 The organization of Technology Scouting

The Process at Deutsche Telekom AG

The process at Deutsche Telekom AG consists of four stages which are shown in figure 4.

Figure 4: Technology Radar Process at the Deutsche Telekom AG



Source: The Technology Radar – Edition II/2006 [38]

In the *identification phase*, a network of technology scouts is used to access sources of information on technological developments in industry and academia. Technologies which may be relevant are outlined in a short summary consisting of a technological description, research status and business potential and are reported to the Deutsche Telekom technology exploration unit. Both internal experts and external consultants are being used as technology scouts.

The *selection phase* consists of two separate screens. In the first screen the technologies are selected according to their degree of novelty. A second screen ensures that the technology is not yet being covered by Deutsche Telekom AG.

In the *assessment phase*, the technologies are ranked according to two criteria: ‘market impact’ and ‘technological realization complexity’. The ranking is done in a workshop with the technology exploration team and the technology scouts. In this workshop all scouts are present in the discussions on all the technologies, ensuring that the cross-technological enabling characteristics of a technology are detected and broader technological trends are identified.

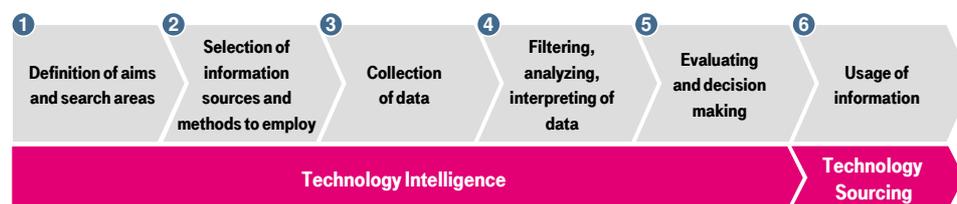
In the *dissemination phase*, the technologies are thoroughly researched by the technology scouts and outlined in a short summary and in a technology one-pager which describes the technology, the latest developments, the research status and the business potential. To facilitate access to the technologies, a visualization – called the Radar Screen – is composed, which categorizes the technologies in technology fields and according to their development status. The findings are then disseminated to the Innovation Strategy, the CTOs and CMOs as a printed document and electronically via the intranet.

Although the Technology Sourcing aspect is not explicitly mentioned in the Technology Radar process, the usage of the technology scouts to get in contact with the sources of their information – which are potentially the sources for the technological knowledge – is supported. This is achieved using three different methods. Firstly, the scouts’ names and contact details are listed in the technology one-pagers. Secondly, workshops are organized in which technology exploration invites interested R&D and product managers to discuss the findings of the scouting network. Thirdly, different follow-up options are offered, including in-depth workshops with the technology scouts and their sources.

The Proposition of a generic Technology Scouting process

Building on the process of Technology Intelligence [29], we can divide the process of Technology Scouting into six stages, as depicted in figure 5. The first five stages are associated with the Technology Intelligence process while the sixth stage is the Technology Sourcing.

Figure 5: Technology Scouting process



Source: Own figure following Reger and Ashton/ Stacey [29, 39]

In the first stage, the *definition of the search areas* takes place. As has already been mentioned in the definition section, the activity is either directed (*Technology Monitoring*), i.e., searching in specific technological fields or undirected (*Technology*

Scanning), i.e., searching for new technological opportunities in white spaces not yet covered by the technological scope of the company. We can divide the generic forms of search activities into random monitoring, compulsory monitoring, scanning and directed studies [40].

In the second stage, the scouts *select the information sources and the methods to employ*. Information sources can be classified as formal and informal sources. Informal sources are especially useful in the high-level areas of technological change and in the detection of discontinuities [29]. Formal sources often have the advantage of enabling the use of automated information searches such as database searches with predefined algorithms. The most frequently used informal information sources are networks, trade fairs, workshops and conferences. The most important formal information sources are journals, technological reports, trend studies and magazines [1].

The selection of methods is dependent to a large extent on the time horizon of the usage of the information. Methods which allow the combination of different methods are also of high relevance. Qualitative methods have an advantage in environments with a high degree of technological change and for the detection of discontinuities [29, 39].

In the third stage, *the data is collected* and often stored in an IT-system for later analysis. Scouts with favorable characteristics are able to collect more data by using a larger network and to select more relevant information using their technological knowledge and their knowledge of the company's needs [29, 39].

In the fourth stage, the collected *data is filtered, analyzed and interpreted*. Generally, the filtering is thought to be best done by the technology scout. The analysis and interpretation, however, is believed to be most effectively achieved in an interactive team process including the information recipients and the technology scouts. Another advantage of the team process is that technological developments, which can serve as an impulse for innovation, are directly disseminated to the participants [29]. By handing over the information to the user it becomes intelligence [41]. In the Technology Radar process the ranking workshop – where the identified technologies are assessed and ranked in terms of relevance – is also organized as an interactive team process. It is believed that the ranking workshop is one of the main elements of value creation in the Technology Radar approach [37].

In the fifth stage, the information communicated by the technology scouts is *evaluated and decision-making takes place*. The outcomes of this stage are decisions such as which R&D investments to make or actions such as the implementation of a technology sourcing activity [41].

The sixth stage is the *usage of the technology intelligence findings*. Ashton noted: "The usage stage is where the intelligence effort pays off" [41]. From that we can derive two things. Firstly, the process has to be directed and tailored in anticipation of the final usage of the information. That implies that the briefing of the technology scouts at the start of the scouting activity is of utmost importance. Secondly, the value is created in the sixth stage. For this reason, the cost/benefit analysis of the scouting activity must be made at this point. The benefits expected by Deutsche Telekom are the stimulation of innovation and the facilitation of the Technology Sourcing. These benefits have to be assessed and compared with the cost of the effort.

After the sixth stage, an assessment of the whole process should take place in order to identify weaknesses and optimize the approach further [39].

The organization of the scouting network of Deutsche Telekom AG

In order to create monitoring and scanning capabilities, which stretch over most of the world, Deutsche Telekom AG has chosen to establish a network of technology scouts. This network looks much like a neural network and uses strong nodes who themselves have their own networks of technological information sources. This scouting network is shown in figure 6 [38].

Figure 6: The Technology Scouting network of Deutsche Telekom AG



Source: The Technology Radar – Edition II/2006 [38]

By using scouts who themselves are well connected to other formal and informal networks, it is possible to considerably raise the number of sources used in the information gathering effort. The main scouting nodes are a full-time consultant in Silicon Valley, three full-time scouts of T-Systems plus 30 scouts for specific technological fields that become active on request, 25-odd scouts at the Deutsche Telekom Laboratories in Berlin and three part-time scouts in Shanghai and Beijing and at the Ben Gurion University in Israel [38].

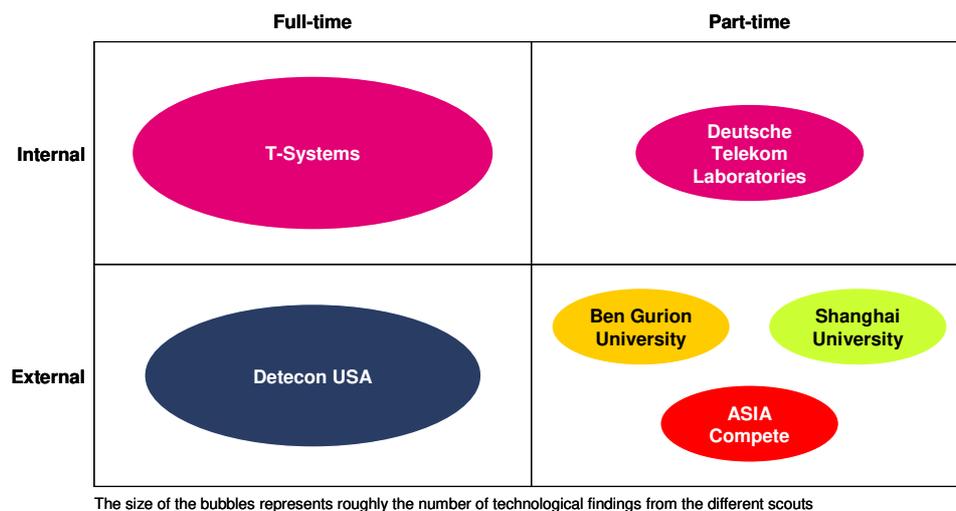
To understand the composition of the scouting network better, we differentiate the scouts into internal or external and part-time or full-time scouts. Such a categorization has been made for the scouts of Deutsche Telekom in figure 7. We can see that the network is rather balanced concerning this differentiation. Having such an allocation, the question arises as to whether it is good or bad to have it balanced in this way.

Wolff has proposed that the ideal scout should be an internal employee who works full-time [27]. Dougherty, in contrast, sees the technology scout rather as a well-known expert, who is hired by different companies as a consultant [42]. Both authors name a variety of different advantages and disadvantages to support their recommendation. The bottom line seems to be that internal full-time employees are superior in the dissemination of information and able to find more relevant technologies by applying their inside knowledge and using their internal network. External consultants, on the other hand, are better at identifying technological developments in white spaces and

might have more in-depth expert knowledge if they have been chosen for scouting assignments in specific technological fields.

From that we might conclude that a balanced scout structure is desirable assuming that their strengths and weaknesses are known and the specific scouting tasks are assigned accordingly.

Figure 7: Typology of Scouts of Deutsche Telekom AG



Source: Own figure with data from interview

Another example is British Telecom's scouting network, which consists of 12 full-time and internal Technology Scouts. This network is designed to serve the overall R&D Strategy of British Telecom, which is driven strongly by so-called *venture managers* who drive the R&D efforts from a customer and market perspective. These venture managers are in need of information that is pushed to them and therefore prefer Technology Scouts who have a good understanding of their information needs. In this respect, the exclusive use of internal employees as scouts ensures the necessary insight in the company to provide information which meets these needs.

Incentive Systems in Technology Scouting

Another aspect of the organization of a scouting network is the incentive system. In the Deutsche Telekom Laboratories scouting network there are two main groups of actors. The technology scouts and the sources of information. These groups can be further differentiated into internal and external scouts, and into academic and industry sources. The different incentives used by Deutsche Telekom AG are shown in Table 2.

Table 2: Incentives for the actors in the scouting network used by Deutsche Telekom AG

<i>Actor in scouting network</i>	<i>Used incentives</i>
Internal scouts	<ul style="list-style-type: none"> • Recognition • Monetary reward in bonus scheme
External scouts	<ul style="list-style-type: none"> • Payment per relevant technology identification • Business Development opportunity
Academic sources	<ul style="list-style-type: none"> • Recognition • Chance for joint research projects
Industry sources	<ul style="list-style-type: none"> • Business Development • Sales • Collaboration opportunity

Source: Data from interview

The incentives mentioned in the table are used and granted voluntarily by Deutsche Telekom AG. In addition, it is plausible that the different actors might have other sources of motivation for collaborating in the scouting network. Other incentives are, for example, learning about technological advances or getting insights into Deutsche Telekom AG [43].

5 Conclusion

For Practitioners

To start a Technology Scouting activity 3 elements are crucial. Firstly, the *goal* has to be set, especially the definition as to whether the scouting should be directed or undirected. Secondly, an *incentive system* has to be worked out that takes into account all actors involved in the process. Thirdly the definition of the *backward-loop* is essential. The company has to ensure that it has something to offer in exchange for the information given by the sources of the scouts. Joint research projects are one such exchange.

Suggestions for further research

In literature, two aspects have been researched very little. Firstly, the expected *value contribution* of Technology Scouting has remained obscure. This is also due to the nature of possible value contributions. In particular, the warning function is difficult to value. To establish this value one would need to know what the consequences would have been if no warning had been given. In addition, the identification of an opportunity which results in an innovation activity is difficult to value as the final revenue generation also depends on the new product development process as well as the commercialization. Secondly, the *division of labor* between internal and external scouts that has been suggested by the case

study has not been proven empirically and would be an important finding for practitioners.

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