

Improving the research and knowledge transfer as a means to improve energy efficiency in production – the German approach *Effizienzfabrik*

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Abstract

As a means to promote the development of innovative energy- and resource-efficient production technologies, the German Federal Ministry of Education and Research (BMBF) launched a programme¹ funding over 31 joint research projects with more than 65 m Euros in 2009. Each of the funded projects aims to develop new, holistic solutions for industrial production which can substantially improve energy efficiency. The purpose of these solutions is to ensure and foster the competitiveness as well as the technological top position of German industry. However, in order to reap the fruits of these efficient solutions, it is necessary that they are spread and adopted by industry.

As a flanking measure to the 31 research projects, the BMBF and the German Engineering Federation (VDMA) therefore launched a joint initiative called the *Effizienzfabrik*, the *Innovation Platform for Resource Efficiency in Production*. The initiative has three objectives: (1) to disseminate information about recent trends and developments in research on energy- and resource-efficient production technologies, (2) to facilitate the dissemination of the project results by publications, events and web-based tools and finally, (3) to create a living network of stakeholders from industry, academia and the public.

In this paper, we discuss the approaches developed for and implemented in the *Effizienzfabrik*. This includes a presenta-

tion of the methodological background, a review of the various tools and services provided to the public and a discussion of lessons learned during the *Effizienzfabrik* initiative. This information may serve as a basis for launching similar programmes in other countries or contexts.

Introduction

Energy and resource efficiency are priority topics in European policy-making: The European Commission sees the 20-20-20 targets – including a 20 percent increase in energy efficiency – among the five headline targets for Europe till 2020. Correspondingly, resource efficiency is regarded among the flagship initiatives as most likely to achieve a “smart”, “sustainable” and “inclusive” growth for Europe (EC 2010, EC 2011). Substantial improvements potentials can be found in both areas: With regard to the industrial sector in Germany, for example, industry estimates its average improvement potentials in energy efficiency at about 15 percent and in material efficiency at about 7 percent (Schröter et al. 2009, Schröter et al. 2011).

While improvements in both areas promise considerable cost savings, efficiency improvements are also a way to enhance international competitiveness and innovativeness. Many national and international research efforts are therefore dedicated to generating and enhancing knowledge about industrial energy and resource efficiency. Such research efforts usually provide very relevant and useful information, both for further research activities and for industrial applications. Yet such results are usually not accessible in a concise, bundled manner and thus transaction costs for searching, identifying and processing possibly relevant information impede the broad dissemination of valuable research results. Methods and tools to overcome such

1. Programme “Resource efficiency in production” within the framework programme “Forschung für die Produktion von morgen”.

barriers and to enhance the dissemination of research results on industrial energy and resource efficiency are therefore urgently required.

The German initiative *Effizienzfabrik* was launched in 2009 as a means to improve the transfer of research results and knowledge about energy and resource efficiency in production. Supported by the German Federal Ministry of Education and Research (BMBF), this initiative accompanies 31 research projects dealing with these issues. Its objectives are (1) to disseminate information about recent trends and developments in research on energy and resource-efficient production technologies, (2) to facilitate the dissemination of project results by publications, events and web-based tools and (3) to create a living network of stakeholders from industry, academia and the public.

In this paper, we provide an overview of the *Effizienzfabrik* and details about different approaches and tools developed for this initiative. We start by providing background information on the concept of barriers, with a special focus on knowledge transfer from research projects, leading into a general concept for improving knowledge transfer. In the second part, we then provide details about the *Effizienzfabrik* and describe the different methods, tools and activities used in the project. Finally, we discuss lessons learned from this transfer initiative before providing some general conclusions on transfer initiatives.

Research and knowledge transfer

BARRIERS TO ENERGY EFFICIENCY AND THE ADOPTION OF RESEARCH RESULTS

Numerous investigations on barriers to energy efficiency in industry were carried out in the past (e. g. Rohdin et al. 2006, Rohdin et al. 2007, Sardanou 2008, Hasanbeigi et al. 2010, Sorrell et al. 2011). Barriers to energy efficiency can be perceived as mechanisms that inhibit “a decision or behaviour that appears to be both energy-efficient and economically efficient” (Sorrell 2004). While there are various classifications of barriers, one commonly used classification (Sorrell et al. 2011) distinguishes six different categories of barriers: access to capital, split incentives, bounded rationality, risk, imperfect information and hidden costs. Especially the latter three categories of barriers are addressed by research and knowledge transfer initiatives. Such initiatives aim to reduce transaction costs and information gaps by providing relevant information in a structured and easily accessible manner and by reducing the perceived risks in energy- and resource-efficient solutions by providing examples of successful implementations.

With regard to information processing, a successful transfer of research results is thus essentially determined by the structures, capacities and patterns of behaviour existing in enterprises. Transfer offers can only meet demand if the absorptive capacity of the group targeted by the transfer is sufficient to discern the offer and integrate it in its own planning and realisation measures (Lay et al. 2009). As Lay et al. (2009) show, this absorptive capacity is very limited for transfer offers in the field of process modernisation and innovations, which also covers the field energy efficiency in production. In many cases, it is probably not sufficient to adopt the available transfer offers. This is particularly valid for small and medium-sized firms

(SMEs). The following example shows the challenges connected with the weak performance of companies with regard to their absorptive capacity and process innovations. On average, German companies employ about ten times more staff for product innovations than for process innovations.² While companies invest only 0.5 percent of their personnel capacities in planning modernisation measures in manufacturing, this rose to 5 to 8 percent on average in the research and development of new products (Lay et al. 2009). Furthermore, Lay et al. (2009) show that the time horizons for planning modernisation measures in manufacturing tend to be rather short (below five years) in many companies, which limits them in picking up on transfer offers from publicly funded research projects and being able to integrate them in their own plans for process modernisation.

Thus, expanding classical transfer offers does not remedy the situation. Alongside incentives to expand absorptive capacity, the only measures which seem promising are those which redesign transfer offers in such a way that the limited absorptive capacities can be used more effectively. The aim must therefore be to reduce the information overflow and to create high-quality transfer offers that can be monitored continuously with less effort.

CONCEPTS TO DISSEMINATE RESEARCH RESULTS

In order to overcome the existing barriers regarding the successful transfer of research results, it is important to understand the mechanism behind it. The efficiency of knowledge and technology transfer not only depends on the quality of the research results or developed approaches and the transfer willingness of the project partners, but primarily on how well the transfer mechanisms function. In his study Warschat (2009) tackles the question of how this transfer function can be promoted within the context of different joint research projects within a funding programme. The core suggestion of this study was that the transfer of project results should not only take place at the level of the joint project. This suggestion was based on the insight that the transfer activities traditionally pursued by the research partners in joint projects result in a fragmented picture of the research results achieved in individual fields of research, for example, via project-specific internet pages. Beyond these measures, however, knowledge transfer spanning a range of projects also appears to be necessary. Planning and organising this type of transfer is challenging because often a large number of joint projects are promoted within the scope of funding programmes. It is not possible for industry to filter all the obtained results or, for example, to scan all the project pages in the search for solutions to specific problems. Industry is not interested in what was developed in which project, but in solutions. The prerequisite for finding these solutions or at least projects dealing with similar or transferable solutions is to supply this information in a transparent and easily accessible manner. It follows from this that the results of individual projects have to be pooled, based on specific problems and target groups.

It is also important to enable information and knowledge exchange both among project consortia as well as with non-

2. German Manufacturing Survey: http://www.isi.fraunhofer.de/isi-en/i/projekte/erhebung_pi.php



Figure 1. The different offers and activities of the *Effizienzfabrik*. Applying these different offers and activities should help to fulfill the objectives of the *Effizienzfabrik*.

funded companies. An internet platform can make an important contribution towards achieving this goal by providing companies searching for solutions with the information about which project is working on which solution. Companies can profit from exchanging information and networking with other companies or research institutions working on problems in joint projects which are also relevant for them.

Another very promising approach to improve the transfer of research results is to plan and conduct suitable types of events. These include special regional events, for example, which are staged with transfer partners such as associations or chambers of commerce and industry. Setting up topic-related working groups which provide a base for exchanging specialist information over a longer period can also make a contribution.

In order to tackle the challenges connected with the transfer of research results and solutions, different transfer projects have been developed in Germany and are funded within funding priorities, such as the integration and transfer project within the funding priority r2 – innovative technologies for resource efficiency – resource-intensive production processes³ and the *Effizienzfabrik* – the innovation platform for resource efficiency in manufacturing. Another initiative which supports and promotes especially small and medium-sized companies regarding short-term solutions to improve their resource efficiency potential is the Centre for Resource Efficiency and Climate Protection (VDI ZRE, “Zentrum Ressourcen Effizienz und Klimaschutz”)⁴. In contrast to the other mentioned initiatives, the *Effizienzfabrik* is clearly focused on facilitating the transfer of research results and solutions as well as the creation of a lively network among its stakeholders.

In the following, the *Effizienzfabrik* will be presented in detail as a successful and widely positioned initiative in the field of resource efficiency which focuses on the proposed approaches and procedures to improve the dissemination of research results.

The German approach *Effizienzfabrik*

The development of sustainable solutions and production technologies focussing on resource efficiency in manufacturing industries is one of the key concepts to improve climate protection (BMBF 2012). Therefore, the German Federal Ministry of Education and Research (BMBF) published an announcement of funding for “Resource efficiency in manufacturing” in autumn 2008. Within this funding priority, 31 research projects

have been initiated with an overall budget of more than 65 m Euros in total, mainly starting in autumn 2009. These joint projects are carried out by teams of academic and industrial partners, involving more than 160 partners from industry (mainly companies from the production technologies sector, especially SMEs) and about 40 partners from academia, such as research institutions and universities. The advantage of these research projects is the close interconnection between industrial and scientific research (BMBF 2012). The projects cover a large variety of different topics in manufacturing and generate a huge amount of information.

As a flanking measure to improve the research and knowledge transfer generated within these projects, the BMBF and the German Engineering Federation (VDMA) initiated a joint initiative called the *Effizienzfabrik*, the *Innovation Platform for Resource Efficiency in Production* as an overarching innovation platform launched along with the projects. Scientific support for the platform is provided by the Fraunhofer Institute for Systems and Innovation Research ISI as an independent research institution.

The objectives of the *Effizienzfabrik* can be classified in three categories and aim to overcome barriers to knowledge transfer, as described in the previous section, as well as improving and accelerating the adoption and use of the research results. The first objective is to provide information about energy and resource efficiency in manufacturing and research-related activities to industry. The second objective is to support all 31 research projects regarding the dissemination of their research results and especially to accelerate this dissemination as well as to facilitate the implementation of their new energy and resource efficient solutions in manufacturing companies. The third objective is to create a lively network of different actors from industry, academia and politics. By implementing these objectives, the innovation platform intends to create a win-win situation for all parties involved.

In the following section, the different activities, approaches and offers of the *Effizienzfabrik*, such as the website, the newsletter, the *Effizienzradar*, events and networking, the *Effizienznavigator* and public relations are described in detail (cf. Figure 1). These different activities and offers are applied to meet the set objectives of the initiative.

THE EARLY PHASE: ANCHORING THE EFFIZIENZFABRIK

As a first step, it was necessary to introduce the innovation platform to the general public as well as to all involved project partners of the funding priority. This was achieved by different activities, among others a public inauguration event which attracted attention to the platform and a road show of the ini-

3. Integration and transfer project r2: <http://www.r-zwei-innovation.de/>

4. Initiative VDI ZRE: <http://www.vdi-zre.de/das-vdi-zre/>



Figure 2. Sample posters and project descriptions. For the inauguration event, each of the 31 projects was provided with an illustrative poster and a flyer with a brief project description, an overview of project partners and contact information.

tiative. Furthermore, it was necessary to identify the common needs of the 31 different projects and more than 200 project partners.

The inauguration event with about 300 participants was organised to publicly announce the start of the *Effizienzfabrik* and to promote the 31 projects. Increasing awareness of the large variety of research projects in the field of resource efficiency in production was one of the main ideas of the inauguration event, so representatives from industry, politics and media were invited. The main focus was to provide information on the 31 projects and to create a framework for networking activities among the 31 projects and the external participants. To draw wide attention to the projects, the audience was guided through a series of concise 5-minute presentations by the project leaders about the objectives of each project. In addition, a market place was organised to provide the projects and the participants with sufficient opportunities for networking. Every project was equipped with a discussion table and poster to be seen in the market place.

The inauguration event was accompanied by the launch of the platform's website (www.effizienzfabrik.de) and a professional printed brochure⁵ with catchy slogans, illustrating and providing an overview of the 31 research projects (cf. Figure 2).

Next to the inaugural event, a "road show" was arranged to inform every project partner involved in the different research projects about the *Effizienzfabrik* and its offers. This road show was arranged to accompany the regular meetings of the research consortia and comprised a presentation of the *Effizienzfabrik* illustrating its activities and benefits for the project partners.

Additionally, a survey was conducted to identify the interests and needs of each project partner regarding specific

resource-efficient solutions in order to design the content of the different prospective activities and events offered by the *Effizienzfabrik*. Thus the survey was oriented along two main axes: to identify information topics and information gaps that the project participants were interested in, on the one hand, and to identify topics for networking activities, on the other hand. The survey covered "Energy- and resource-efficient manufacturing equipment, machines and components", "Energy- and material-efficient solutions for manufacturing processes and process engineering", "Measures and approaches for improving energy and material efficiency" as well as "Tools to analyse and assess the potential and the solutions of energy and material efficiency". A return rate of over 50 percent provided a sound basis for planning further activities in the transfer initiative.

THE VIRTUAL PLATFORM OF THE FUNDING PRIORITY – THE WEBSITE WWW.EFFIZIENZFABRIK.DE

Online platforms are a means to reduce duplications and facilitate accessing the information (Evans et al. 2008). The visitors of an online platform benefit from a greater variety of information about research in the field of resource efficiency in manufacturing, as a website serves as the focal point within and beyond the key subject of the funding priority, as all the different projects and other additional information within that field of research are displayed on it. At the same time, it reduces the amount of time needed to search for the diverse information and virtually convenes the different interest groups which are offering and demanding resource-efficient solutions in manufacturing. Hence, a platform which provides support for interaction is an effective tool for publicity and creates value which could not be obtained elsewhere.

The website of the *Effizienzfabrik* is based on five pillars:

- an overview of the 31 research projects,

5. Brochure of the 31 projects (in German): <http://www.effizienzfabrik.de/sites/effizienzfabrik/files/bilder/Effizienzfabrik-Brosch%C3%BCre%200kt%202010.pdf>

- a regularly updated section on national activities in research in the field of resource efficiency in manufacturing, called *Effizienzradar* (“efficiency radar”),
- a structured overview by topic of solutions developed by the participating projects, called the *Effizienznavigator* (“efficiency navigator”),
- a section on publications from the innovation platform, and
- a section on news and current issues and background.

Overview of the 31 research projects

An outline of each research project can be found on the website. In order to structure the projects, they are sorted according to their thematic affiliation in five subcategories: “New technologies for efficient production and manufacturing technologies”, “Simulation and assessment for efficient production and manufacturing technologies”, “Efficient production tools and machines”, “Production-induced product characteristics” as well as “Functional surfaces”. For the user of the website, there is also a free text search as well as an index according to the different project partners and the specific industries available. Next to the outline of each project, all involved project partners, their contact information, link to their project-specific website and links to their developed solutions as well as publications can be found.

The *Effizienzradar*

The so-called *Effizienzradar* compiles an overview of activities in the field of energy and resource efficiency in production from outside the funding priority. It contains information on events, publications and studies from industry and academia as well as other research projects, platforms and initiatives. The announced events and initiatives are limited to the national level. However, EU projects and publications in English which are thematically suitable are also referred to. For each item in the *Effizienzradar*, a brief summary explains the main content of the items and provides further references to the corresponding sources.

The *Effizienznavigator*

The *Effizienznavigator* (“efficiency navigator”) has been designed to provide an overview of specific solutions developed by the 31 projects and as a means to disseminate project results, structuring the results in a user- and target-group-specific way. The starting point of the *Effizienznavigator* is a content-specific tagging of each research project based on the project description. At the same time, a thematically rooted tree which covers all the different aspects of the funding priority has been developed, fitting the tags of the research projects. The rooted tree consists of two sub-levels. At the first level, the six different categories divide the widespread topic resource efficiency in manufacturing. To facilitate access and to address the needs of the user of the *Effizienznavigator*, who is searching for solutions, all six categories have been formulated as a question. These categories cover the topics “Saving resources in production such as energy, material and waste”, “Resource-efficient solutions due to process reconfigurations and improvements of material characteristics”, “Resource-efficient manufacturing equipment, machines and components”, “Solutions for resource

efficiency in manufacturing technologies” and “Solutions for resource efficiency in process engineering” as well as “Different tools to analyse and assess the resource-efficiency potential and resource-efficient solutions”. On the subjacent level, each of the six categories are split up into more specific options, which are already linked to the specific research projects doing research and developing solutions. In the beginning, only the research projects could be found according to their tags. Over the course of the project progress, the solutions developed by the research projects are added to the *Effizienznavigator* and are pooled among the different categories. These solutions can either be presentations or publications which have been disseminated by the research project. The relevant tags of the project are assigned to each solution in order to locate it in the *Effizienznavigator*. Moreover, each solution consists of a short summary, describing the added value and transfer possibilities of the research result, indicates the contact person including contact details and offers a link for downloading, or refers to the original source. Thus, the *Effizienznavigator* is a tool which facilitates the transfer from a project-related view, preferred by the originator of the result, towards a problem- or solution-specific offer.

Publications on www.effizienzfabrik.de

The internet platform provides an overview of all publications generated by the *Effizienzfabrik*. At this stage of the projects, more than 40 publications have been published in specialised journals. Additionally, it contains a list of all press releases and presentations held during the different events organised by the *Effizienzfabrik*. Furthermore, based on the results of the initial survey, two short studies on cross-cutting topics have been published. One of the studies focuses on energy management systems in industry (Hirzel et al. 2011) and the other on the economic assessment of energy-efficient manufacturing equipment (Mattes and Schröter 2011). They are a supplement to the technical and engineering-specific solutions developed in the research projects. The studies are also linked to the tool *Effizienzradar*, which serves as a valuable input source for the state-of-the-art overview of the studies. Further studies are planned as future tasks to support the thematic configuration of the different events organised by the *Effizienzfabrik*.

News and current issues

The website is also a tool to display funding announcements, which address the target group and thus an important part of the public relations. Additionally, a chosen interview in one of the research projects is displayed, which changes on a regular basis, to increase the added value of visiting the website by adding new insights into the project. Every two to three months, a newsletter is released, based on the items of the *Effizienzradar* which informs about past as well as future highlights, such as upcoming events and event reviews. It is also a means to promote the website, captured in the number of website visitors. After sending out the newsletter, a significant increase in visitors of the website was recorded.

EVENTS OF THE EFFIZIENZFABRIK – NETWORK!

Important elements of the *Effizienzfabrik* are to inform industry about resource efficiency in manufacturing, support the research projects in disseminating their research results as well as

create a lively network, which is achieved by the different types of events organised by the *Effizienzfabrik*.

Besides the described inauguration event, different event concepts have been developed by the *Effizienzfabrik* team, based on the interests and needs identified in the conducted survey. The different concepts can be divided by their size and thematic orientation.

Regional events

One approach is the organisation of regional, decentralised events which are conducted in cooperation with the regional offices of the VDMA. They consist of a series of events on a specific topic and are spread regionally all over Germany. The venue of the event is preferably at a company, to include a tour of the manufacturing site. Representatives from industrial firms in the region are generally invited. Besides topic-specific presentations of the *Effizienzfabrik*, different project partners give insights about their specific project in the funding priority. This type of event is rather of an informative character and aims at getting to know other companies and their solutions in the field of resource efficiency in manufacturing.

The first series tackled the topic economic assessment of energy-efficient manufacturing equipment. The above mentioned study was written within this context to give the participants valuable information. A second edition with a different topic is planned for the remaining project duration.

National events

In addition to the regional events, activities at the national level are also organised. Their aim is to reach a bigger target group. Content-wise, this type of event focuses on the presentation of the first solutions developed by the research projects. These events thus contribute to the transfer of solutions for special target groups and are a means to set up a place for networking.

Within the course of the research projects, three national events were organised, dealing with the topics simulation and assessment of resource efficiency in manufacturing, energy management as well as functional surfaces. The event topics were identified in the conducted survey, which were of most interest to the project partners involved.

In contrast to the two events about simulation and assessment and functional surfaces, the event about energy management was not only about informative presentations. A part of the event was dedicated to holding workshops with the participants, in order to have some "hands on" characteristics, to have active participants and leave more room for discussions. Additionally, the second study about energy management that was prepared for this event is also available for download on the website of the *Effizienzfabrik*.

As a counterpart to the inauguration event of the *Effizienzfabrik*, a joint closing event of the funding priority will be organised. The aim of this event is similar to the opening event; it should shed light on the funding priority as a whole and increase the awareness among politicians and the public. For this occasion, a brochure summing up the solutions developed in each project will be published.

Moreover, each project organises its own closing event in which the focus is on the technical solutions developed to improve and to contribute to research in the field of resource efficiency in production. Depending on the target groups of the

developed solutions, those can be independent events, joint events with other research projects of the funding priority, or the event itself is integrated in a trade fair.

Workshops for topic-related networking

In order to involve the project partners more actively, to use the knowledge and the solutions developed in the projects for new research problems, as well as to discuss strategic topics, topic-specific workshops have been initiated. Two different approaches have been developed for this kind of event. On the one hand, the workshop of the national event about energy management was used to identify topics which are of high relevance for further discussion. On the other hand, the *Effizienznavigator* was used to identify interfaces and overlaps between the research projects at the project partner level. In contrast to the first approach, only internal actors of the funding priority participated in this workshop. The value chain about injection moulding and its influences on resource efficiency was identified as a first topic for this workshop. Depending on the strategic importance of the topic, the aim is to continue these initiated working groups as self-sustaining industry working groups.

Integration in other events

Besides the different types of events organised and offered by the *Effizienzfabrik*, participation and promotion of the innovation platform in other big events organised by thematically linked initiatives or networks, as well as presenting the *Effizienzfabrik* during trade shows are part of the strategy to embed the topic resource efficiency in manufacturing in industry, academia and politics. It can be seen as an important element of the public relations activities of the *Effizienzfabrik*.

PUBLIC RELATIONS AND MARKETING – INFORM!

The public relations activities conducted by the *Effizienzfabrik* are connected to all of the activities of the innovation platform, as an over-arching element. Offering printed materials, maintaining the website, designing and writing the newsletter, writing press releases as well as attending events organised by other initiatives than the *Effizienzfabrik* are basically the role of the public relations actors. The added-value of the public relations lies especially in the thematic orientation.

Lessons learned and future perspectives

So far, the *Effizienzfabrik* has been successfully established as a brand within the German research landscape devoted to resource efficiency in manufacturing. Due to the diverse offers and activities (cf. Figure 3), the innovation platform is well known among its target audience and a lively network among industry, research and politics was created. Since the start of the website, an ever increasing use of the website and the newsletter was observed. With the first of the 31 projects publishing their solutions, support of the dissemination activity was started by providing topic-related solutions via the *Effizienznavigator* and by the conducted events. However, until and also after the closing events of the research projects, disseminating the developed solutions will be one of the main tasks still to be accomplished.

Transfer initiatives such as the *Effizienzfabrik* are complex endeavours. Likewise, it is important to quantitatively monitor

such initiatives in order to analyse their effective functioning as well as the quality of the transfer mechanisms. To evaluate the impact and the effectiveness of the offers and activities of the *Effizienzfabrik*, it is useful to define some success indicators. These indicators should be connected to the main objectives of the initiative:

- to disseminate information about recent trends and developments in research on energy- and resource-efficient production technologies,
- to facilitate the dissemination of project results by publications, events and web-based tools and
- to create a lively network of stakeholders from industry, academia and the public.

With about 70 percent of the transfer initiative duration completed, the development of the indicator number of unique visitors of the internet platform seems to be suitable to evaluate exemplarily the visibility of the initiative, as well as the effectiveness of the implemented internet platform. With regard to the overall visitors per month, a continuously increasing number was observed over time (cf. Figure 4). The peaks in the chart are related to the sending of the newsletter, which indicates the added value of the newsletter and which currently has around 800 recipients. Additionally, a more detailed analysis shows that the pages on the short studies, events in the *Effizienzradar* and the *Effizienznavigator*, which provide the developed solutions of the research projects, are the most visited pages.

The development of the indicator number of visited pages per visit can be explained by different arguments (cf. Figure 4). At first, the users wanted to have an overview of the different pages available, e. g. the project descriptions. This could be explained by the novelty effect. With an increasing number of visitors and a longer internet platform lifetime, the number of visited pages reduced. Reasons for this development could be the levelling effect as well as a more selective search for information by the users.

Comparing the results of these indicators with the objectives of the *Effizienzfabrik*, especially the aim to support the information transfer and exchange, it can be stated that the implementation of the internet platform, including the tools *Effizienzradar* and *Effizienznavigator*, the short studies supplied and the newsletter are effective offers provided to the target group.

Furthermore, in order to provide insights and recommendations for similar endeavours, e. g. for similar implementations in other countries or for other topics, we discuss some preliminary lessons learned. From our point of view, the following points and suggestions for improvements are noteworthy:

- As with any other project, a transfer initiative needs time to plan and refine its project concept. As the innovation platform started at the same time as the 31 research projects, the offers to and the interaction with the research projects could only be realised after a certain start-up phase. In retrospect, we find it advisable to start initiatives like the *Effizienzfabrik* sufficiently in advance of the other research projects.

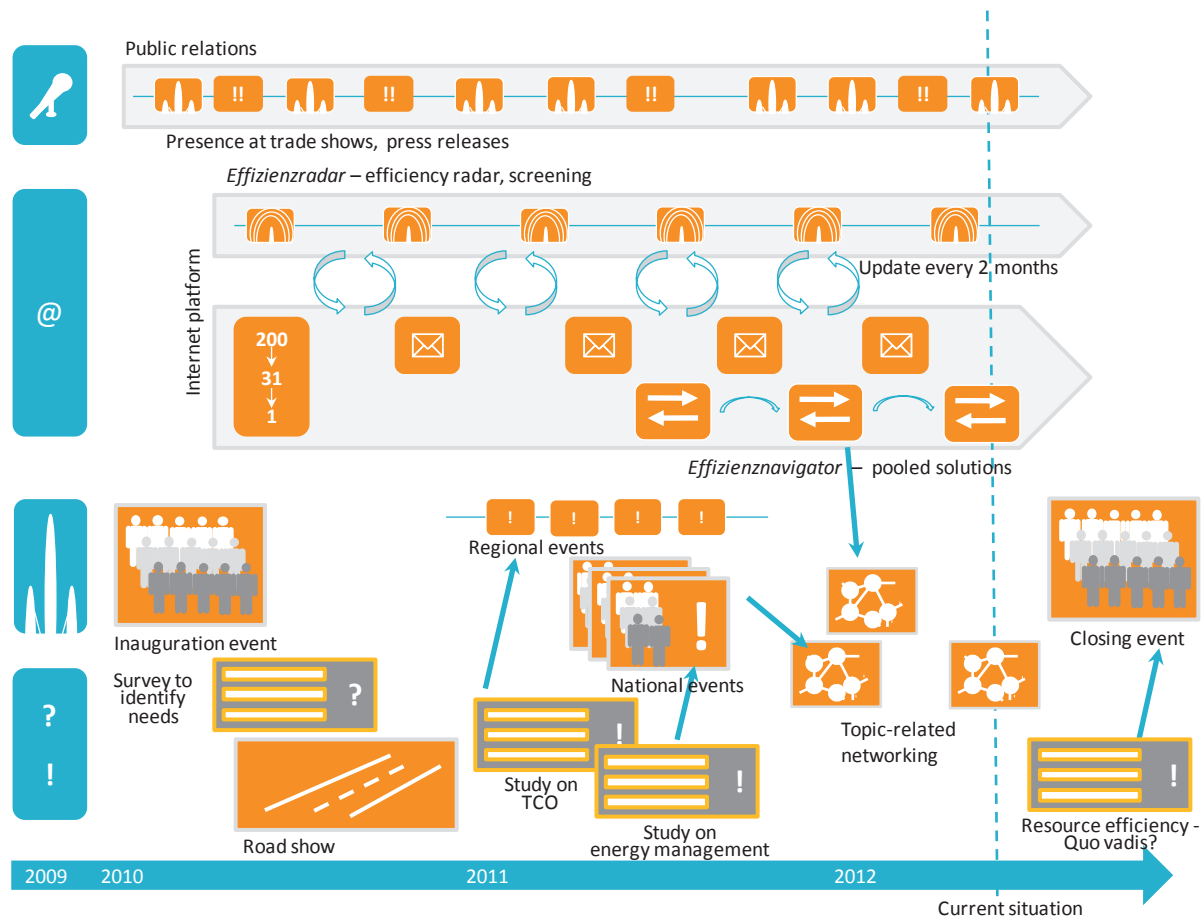


Figure 3. The different approaches and activities of the *Effizienzfabrik*. This figure sums up the different actions taken and planned by the *Effizienzfabrik* in chronological order.

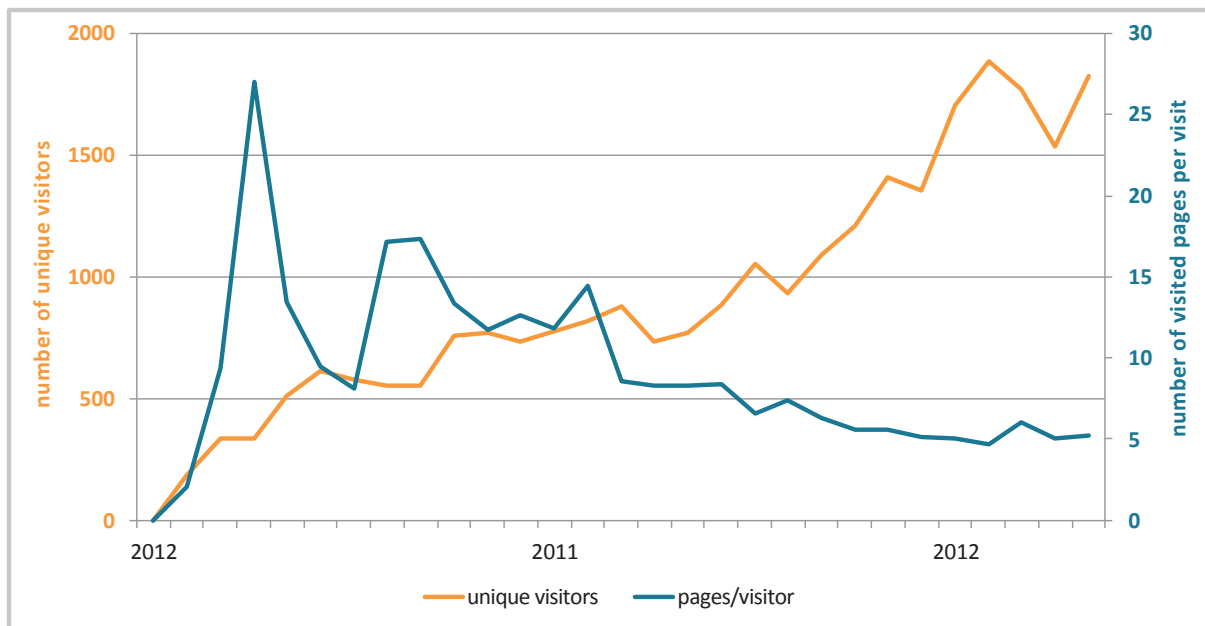


Figure 4. Use of the internet platform. The increasing number of visitors since the website start-up in early 2010 indicates the ever increasing interest in the platform and in the results made available for transfer.

This allows accompanying research projects from the very beginning, including the possibility to provide up-to-date information to the projects right from their very beginning, which is a phase when information is especially important for the projects.

- Another issue of timing concerns the start of the different research projects. Some projects in the *Effizienzfabrik* started half a year before others. Thus jointly planned activities such as surveys, networking activities and closing events are difficult to organise benefitting all projects and joint activities are not always easily feasible.
- Even though most of the project partners in the 31 projects actively contributed to the initiative and made use of the offers and activities of the innovation platform, it seems advisable to set up a mandatory requirement to participate in the transfer initiatives, along with the funding. This was not the case for the *Effizienzfabrik*. Though such a measure might seem restrictive, on the one hand it could improve the dissemination of the publicly accessible parts of the project results and, on the other hand, it could improve early networking activities between the projects concentrating on similar goals.
- In order to strengthen the transfer of the research solutions in a target-group-specific way, it might be considered whether project-specific websites and events should be avoided. Individual activities conducted by each research project in turn require binding resources that projects could rather dedicate to their research goals, and parallel activities counteract the idea of a joint platform.
- The team of the *Effizienzfabrik* consisted of members of an industrial association, a research institution and specialists for public relations, as well as professional designers. In our perception, this combination was very beneficial to the *Effizienzfabrik*, as an industrial association possesses a large

network of member companies and provides an easy access to industrial companies, a research institution can provide relevant scientific input, both with regard to concept and contents, and specialists in communication and designers assure that communication is done in a professional manner.

- During the initiative, we could observe that several projects were interested in obtaining specific support in questions laterally relevant to their actual research topic. While the budgeting of the initiative did not allow for processing of such specific questions thoroughly, one might consider in future offering such a service to projects at an early phase.
- In order to more easily identify synergies between the different research projects, it seems advisable to limit the number of people in touch with the different projects to a minimum. Projects could thus benefit from fewer people knowing the contents addressed in the projects very well. Additionally, this would facilitate bringing more different projects together and creating synergies for the projects, provided that sufficient funding and a good timing is provided for such activities.

With regard to the future perspectives of the innovation platform, it is planned to continue the *Effizienzfabrik* beyond its current funding period ending in late 2013. Thus the established brand and the networks shall be kept alive. Furthermore, we hope that spin-off activities such as the initiated industrial working groups will be carried on, actively supported by its participants.

Conclusions

This paper discusses methods and approaches used in the German initiative *Effizienzfabrik*, which aims to promote the research and knowledge transfer to improve resource and energy efficiency in production. The initiative shows that a transfer plat-

form for research programmes in the field of resource efficiency can be an effective means to facilitate the dissemination of research results and to overcome existing barriers to energy and resource efficiency. Key benefits of such transfer platforms are that research projects can concentrate on their research activities, while the platform provides them with additional means to disseminate their research results. Furthermore, as the innovation platform pools results and constantly provides information on the progress of projects and on external developments, visibility of the funded research projects, its project partners and funding organisation are increased. Finally, making project results accessible to the interested public by presenting them in a target-group-specific way facilitates research on possibly relevant solutions. Thus this transfer initiative reduces transaction costs and is likely to increase the adoption of energy- and resource-efficient solutions in practice. The so far obtained results of the initiative are promising and can be recommended as a starting point for setting up similar initiatives in other countries or contexts.

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