The Transfer Dashboard: Integrating the Third Mission into the University Infrastructure

Jan Bernoth[1], Ulrike Lucke[1]

[1]University of Potsdam, Dpt. of Computer Science, August-Bebel-Str. 89, 14482 Potsdam, Germany
firstname.lastname@uni-potsdam.de

Keywords
Third mission, transfer, dashboard, analytics

1. ABSTRACT

The goal of this paper is to introduce aspects of transfer (the third mission) into the digital infrastructure of a higher education institution (HEI). While there is little visibility of transfer characteristics in discussions on digital infrastructure, the political importance of this topic is growing. Therefore, our approach is to extend the infrastructure of HEIs with features from modern data analytics. We identified sources relevant for transfer and visualize them in a dashboard. As a first step, we designed descriptive or diagnostic components for the different fields of transfer. Building on this, next steps towards predictive components are discussed.

2. Motivation

HEIs are mainly focused on three missions: education, research, as well as transfer of knowledge and technology. In the late 20th century, knowledge and technology transfer (the third mission) was set up as transfer offices at German universities. By integrating the third mission into the institution, the idea of transfer changed from a one-way output to a multidirectional exchange (Krücken, 2014).

In contrast to the political efforts in funding third mission projects, the discussion about the digital infrastructure at HEI leaves out digital needs of the third mission. It is mostly about advancing components for education, research, and administration, for example considering current recommendations for information processing (Deutsche Forschungsgemeinschaft, 2016).

The German Science Council identified the third mission as a dimension that contributes to the opening of science to society and industry (Wissenschaftsrat, 2016). Here, the third mission is subdivided into three fields of action: communication, consulting, and deployment. *Communication* creates a channel to arouse awareness in science or to help educate interested parties. *Consulting* maps the field of advisory councils for scientific debate in economy, politics, or society. Finally, *deployment* describes the traditional approach of knowledge and technology transfer by patenting or founding scientific results. Our approach is to detect potentials for digital support in all of these fields.

The large amount of data available in the scientific and administrative environment of HEIs opens up several opportunities to discover innovation potential or to make synergies with local or external stakeholders visible. Hence, it is necessary to have this data available in a non-proprietary and machine-readable format. Despite the overall objective to gain insights, every organization has to climb the ladder of analytical maturity. As outlined in the Analytic Ascendancy Model (Laney et al., 2012) it is essential first to create descriptive and diagnostic analytics and then move on to predictive and prescriptive analytics. Consequently, we started to design descriptive components for third mission analytics.

3. The Transfer Dashboard

A dashboard is an instrument to analyze and visualize data in a compact format; thus, it supports people in getting an overview of relevant fields and acts as their entry point for further activities (Ousterhout, 2018). The different components of the dashboard give the user the opportunity to make data-driven decisions. Hence, a dashboard can be constructed out of the above-mentioned analytics components and provide the user information of real-time, daily or other periodic time intervals. Integrating this dashboard into the work-life of scientists shouldn't require any effort, which means that the dashboard has to be integrated in an existing working platform and the visualizations must not require any extra information or at least only a minimal amount of user input to work correctly.

For the work presented here, we decided to make use of an existing platform for education and research (Kiy, Lucke & Zoerner, 2014). It was designed to support flexible forms of cooperation between teachers, students, and researchers at the University by a) combining a variety of existing tools (like learning management systems, wikis, blogs, chats, calendars etc.) into a consistent environment and b) allowing to create individual workspaces for collaborating in groups out of these tools. The platform connects to all major IT-systems of the University via structured APIs. Moreover, information flows across these systems are consolidated, for instance, in an overall event log.

The dashboard described here acts as an additional starting point for this academic cooperation platform (Bernoth, Kiy & Lucke, 2019). It consists of several components to visualize single aspects of academic exchange. The overall question for designing these dashboard components was: How to improve the visibility and outcome of the third mission? In this respect, it was essential to cover all fields of transfer: communication, consulting and deployment. For our dashboard, we developed six prototypical components from these fields:

1. appearance of science in press
2. evaluation of transfer events
3. interdisciplinary exchange
4. consulting activities
5. patenting and start-up activities
6. daily transfer tips

They are described in more detail in the following, grouped by the respective fields of transfer.

3.1. Communication

One way to visualize the impact of HEI's research in the local non-scientific society is to measure how often scientific results appear in media. For this purpose, we use the available *academic press reviews*, which are a daily summary of a keyword-based search in regional and national newspapers, social media etc. and are delivered in an email format. A number of keywords (topics, institutions and persons) were defined to select the relevant press items. For each article in this review, metadata indicates the circulation and range of the medium. Those metadata can be tracked and visualized over a certain time to see which topics are relevant for science and society.

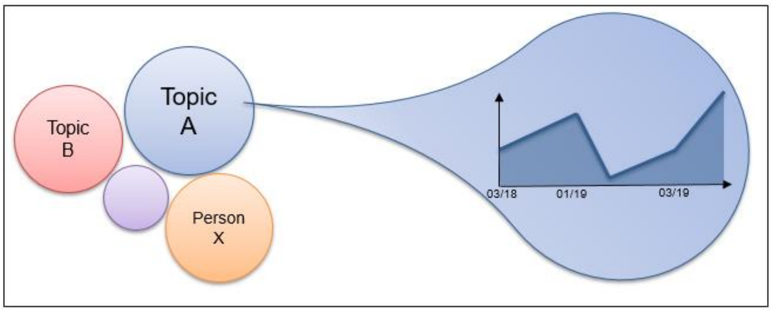

Figure 1 Visualization of relevant topics in press and media

The design prototype for this visualization is shown in figure 1. In their personalized dashboard components, the scientists assemble their own set of relevant topics or persons. The size of the circles illustrates the actual appearance of the topic in press media: the bigger the bubble, the more relevant the topic. By clicking on a bubble, a more detailed view shows how the attention of media changed over the past time. This provides the users with a possibility to reflect the impact of their scientific work in society.

To match the results from the press review with the shown visualization, it is necessary to enhance the articles with a sophisticated topic tagging. Since the texts are not extended with any tags or keywords, a natural language processing pipeline is required to analyze the articles. Probably, the autogenerated keywords are not as meaningful as manual keywords tagged by experts, but they are a valid starting point for the visualization. Another possibility to connect the non-tagged articles with the reach of the medium given in the press review is to index the articles or texts with a full-text search engine like Solr[1] or Elasticsearch[2]. The disadvantage of this approach is that the user has to find suitable keywords for the topics in the database. Due to the ambiguity of the wording, it may happen that some topics are not covered. That's why we do not follow this approach for now.

A second approach for the dashboard to make visible the communications effort within the third mission is to support the *evaluation of events*. Transfer agencies organize several workshops, panel discussions, fairs etc. regularly. These activities can reach different target groups. However, descriptive data on the success of such events are rarely available, since most events follow a physical meeting format and, for example, participants list are not gathered automatically.

To support these fields with analytics tools, we made use of the existing event calendar of the University, in which all scientific events across University are listed together with a description, responsible persons and metadata like time, place and tagging. These tags can be used to identify transfer-related events from the large database, and the associated contact persons are contacted by email on a regular basis in order to collect evaluation data on their events. They can set their own goals for the events with questions like:

- How many participants do you expect?
- What are your focused groups?
- How much participation do you expect?

After the event, the person can reflect on the success of the event by comparing actual data with the goals. Both datasets are collected via an online questionnaire. Thus, it is now available for further use in official statistics as well as for visualization in the dashboard.

A third dashboard component is based on the idea that transfer is stimulated where conventional borders are exceeded. That's why we put a focus on *interdisciplinarity in research activities* in order to identify potential topics for later transfer activities.

For this purpose, we have developed an interface to project databases of public funding bodies, like the German National Science Foundation and the German Federal Ministries. They provide information on all funded research and development projects, including the title, descriptions, names and affiliations of researchers, amount and duration of funding. Using a Natural Language Processing pipeline, we analyzed the descriptions for the disciplinary basis as well as interdisciplinary connections of these research projects. The resulting structure of topical relationships can be browsed in an interactive visualization, as depicted in figure 2[3]. The information in the graph can be filtered for the local organization or a certain discipline.

[1] https://lucene.apache.org/solr/, last visited 15.05.2020

[2] https://www.elastic.co/elasticsearch/, last visited 15.05.2020

[3] The navigable visualization, created by Balaji Subramani, can be viewed under the following link: https://public.tableau.com/profile/balag752#!/vizhome/IDSimilarity/Interdisciplinary last visted 15.05.2020

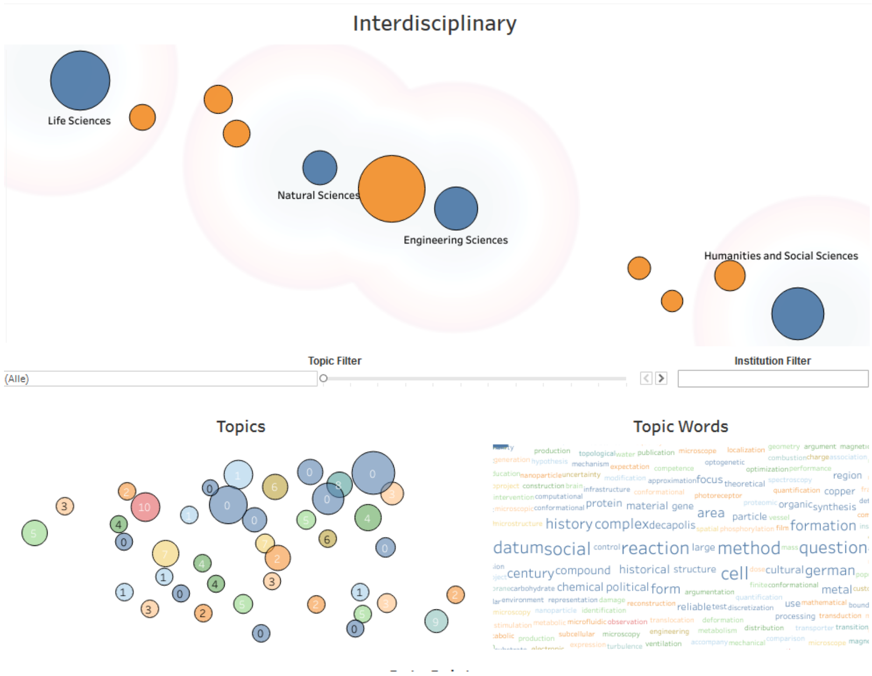

Figure 2 Visualization of interdisciplinarity in research projects

This work was inspired by (Oppenlaender, Benjamin & Müller-Birn, 2017). The visualization can be used for two primary purposes. First, researchers active at the borders of their disciplines can be easily identified by transfer scouts to stimulate their third mission activities. Second, a comparison of local against overall patterns of interdisciplinary research activities may reveal individual strengths or blind spots of local research, which may then lead to strategic changes in regional fundings or communications.

3.2. Consulting

It is challenging to find reliable data for the consulting activities of scientists. One possibility is to browse their publicly provided CVs on websites in which many scientists state their memberships in committees, councils, etc.. Analyzing the CVs with an algorithm is challenging because the entries in CVs are unstructured and have a non-standard vocabulary. We are currently working on an approach to filter reliably consulting activities.

With an appealing system of benefits and trust in the data usage of the institution, scientists could be more motivated to keep their CV up to date and correct wrongly captured data. One benefit could be a badge system, in which well-connected scientists can get badges like “Expert in Political Consulting”. In combination with an open standard like Open Badges[4], scientists could take theses badges with them in their career. Another benefit could be if the university honor outstanding consulting activities with an (annually) award or journalistic article in the University’s journal or local press. Thus, this approach to mutually improve scientific CVs can be seen as an instrument for organizational development.

For the visualization of the CV component in the dashboard, the user's perspective is crucial. From the perspective of a scientist, especially for younger scientists, it could be interesting to see in which organizations or committees they could participate. For experienced scientists, a time-based visualization may be interesting to reflect on one’s scientific career. From the administrative perspective, a visualization should reflect the connection of working groups or the whole organization with economy, politics or society. A proper design for these purposes is the subject of our current work.

[4] https://openbadges.org/, last visited 15.05.2020

3.3. Deployment

This field is the traditional core of the third mission. For this reason, transfer advisors are already being used to assemble descriptive data for reports on recent *patenting and start-up activities*. The challenge here is not to collect the data but to centrally maintain the collected data for further processing. The transfer officers have to pass over their manual notes into a central data storage. Moreover, this requires a strategic agreement on data policy for the third mission activities, where conflicts of interest between local research activities and external cooperations may easily arise. This is even more sensitive since deployment activities need to be supervised from a very early phase, but have to be confidential until a relatively late stage.

Once stored in a re-usable, central database, information on patenting and start-up activities can be used in dashboards both for statistical analysis and for selected qualitative descriptions. In research areas with a high amount of such deployments, it could be informative for young scientists to see the potential of transfer activities in numbers. Another application is to use the data to create a news feed for a research area in which every interested scientist can see current patents and start-ups. This could inspire their scientific work or motivate for outreach activities.

Areas with well-established reporting practices and data grounding can be used to raise the level of analytics from descriptive to diagnostic. For example, the collaboration platform containing our dashboard can be used to track and visualize the relationships between people, topics and activities as a networked. This can help to identify key actors and topics for transfer advisors. This analysis, combined with the patenting and start-up activities, is a valuable basis of a predictive component that helps to scout early innovations.

Previously, this work was done by transfer advisors on a manual basis, by arranging bilateral or group discussions with interested researchers and facilitating a set of transfer guidelines that might help to stimulate third mission activities. With the availability of the dashboard, this collection of helpful experience was now transferred to a set of smaller *tips of the day* to be displayed randomly. They show, for instance, exemplary transfer projects, successful transfer actors, helpful transfer instruments or current transfer events. Thus, the visibility of transfer to the individual researcher can be raised and transfer barriers can be lowered.

4. Micro-service Architecture and the Dashboard

The architecture of the dashboard presented in this article is based on a set of micro-services to prepare the data and a central visualization of this data, as shown in figure 3. Despite the challenges in the complexity of development and supporting different code repositories, this micro-service architecture allows a flexible, scalable and transparent operation.

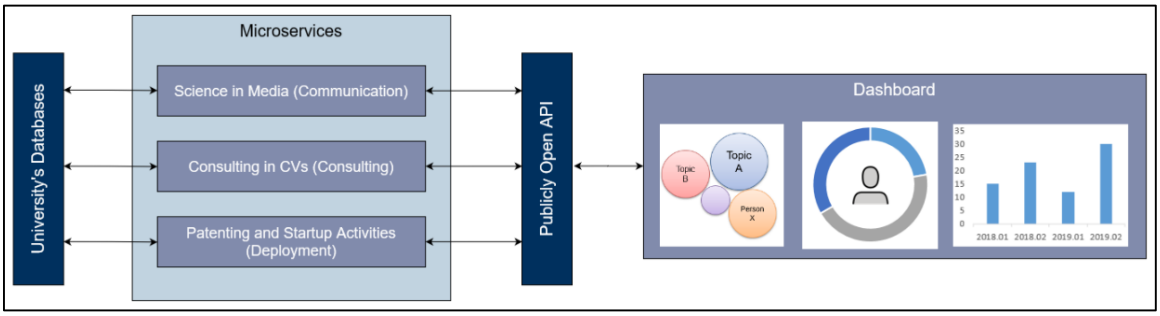

Figure 3 Architecture of the microservices connected with the dashboard

Flexibility is needed because of the volatility of programming staff and the nature of prototyping in University's software development. Development if typically carried out by scientists, students as well as central IT staff with a heterogeneous range of skills. The micro-service architecture allows them to focus their work on a smaller scope precisely defined by an API.

The technical architecture allows the micro-services to operate independently from each other and with different datasets. This leads to higher scalability. It does not necessarily imply a good performance, but with no dependencies between the micro-services, the performance is rather determined by the IT infrastructure than by the architecture.

In analytics, open and transparent development is needed to build a trustworthy environment for users. For this purpose, the concept of the micro-services is to make the API available for every client with an institutional login. As a result, the dashboard is a possible way to visualize transfer relevant data. Still, it does not limit interested people in creating their own visualization or application based on that data.

5. Conclusion

Mostly, analytics in HEIs is used to support processes of education (learning analytics) or research (scientometrics/altmetrics). The third mission is often perceived as an independent task, which can only be achieved at extra cost. In this paper, we present an integrated approach for a dashboard with analytical components that are based on existing data. We present several analytics components in the fields of communication, consulting, and deployment.

The technology and analytics behind the proposed components are not top-notch or experimental. There is no need in the current state of understanding and working with transfer data to create new algorithms. However, there is a need to evaluate the usefulness of existing data in the light of conclusions that can be drawn from them. The intention behind the dashboard is to visualize how science is connected to society and to show at which points science is more inviting.

The presented dashboard, as in instrument that combines the different levels of data (from research, education, and transfer), tools (digital and analog, online and offline) and organizational aspects (embedding in a socio-technical infrastructure), can also be used as a driver for institutional change in HEIs (Kiy, List & Lucke, 2017).

Further research will evaluate whether and to what extent the dashboard may increase the visibility of the third mission in HEIs.

6. COPYRIGHT NOTICE

7. REFERENCES

Bernoth, J.; Kiy, A.; Lucke, U. (2019). Analytics-Dashboard für Lehre, Forschung und Transfer. Proc. DeLFI, Die 17. Fachtagung Bildungstechnologien (Pinkwart, N.; Konert, J./ eds.), LNI P-297, Bonn : Köllen, pp. 333–334.

Deutsche Forschungsgemeinschaft. (2016). Information Processing at Universities – Organisation, Services and Systems: Statement of the Commission on IT Infrastrucutre for 2016–2020. https://www.dfg.de/download/pdf/foerderung/programme/wgi/kfr_stellungnahme_2016_2020_en.pdf

Krücken, G. (2014). Higher education reforms and unintended consequences: a research agenda. Studies in Higher Education, 39 (8), 1439–1450. https://doi.org/10.1080/03075079.2014.949539

Kiy, A.; List, C.; Lucke, U. (2017). A Virtual Environment and Infrastructure to ensure future readiness of Data Centers. European Journal of Higher Education IT (EJHEIT) 2017-1.

Kiy, A.; Lucke, U.; Zoerner, D. (2014). An Adaptive Personal Learning Environment Architecture. Proc. Int. Conf. on Architecture of Computer Systems (ARCS) / E. Maehle et al. (Eds.), LNCS 8350, Berlin : Springer, pp. 60-71.

Laney, D., Bitterer, A., Sallam, R., & Kart, L. (2012). Predicts 2013: Information Innovation. Gartner.

Oppenlaender, J.; Benjamin, J.; Müller-Birn, C. (2017): Socio-technical Revelation of Knowledge Transfer Potentials. Proc. 6th AAAI Conference on Human Computation and Crowdsourcing (HCOMP), Quebec City, Canada.

Ousterhout, J. (2018). Always Measure One Level Deeper. Communications of the ACM, Vol. 61, Nr. 7, pp. 74-83.

Wissenschaftsrat. (2016). Wissens- und Technologietransfer als Gegenstand institutioneller Strategien: Positionspapier. https://www.wissenschaftsrat.de/download/archiv/5665-16.pdf

8. AUTHORS' BIOGRAPHIES

Jan Bernoth is a research assistant at the Institute of Computer Science at the University of Potsdam. He is working in the project "Innovative Hochschule" which is founded by the Federal Ministry of Education and Research. His research interest is about analytics, infrastructure and the beauty of data. Jan Bernoth holds his Master degree of Science (2017), worked as a Software Developer and is a member of German Informatics society.

https://www.uni-potsdam.de/en/multimedia/team/staff/janbernoth.html

Prof. Dr. Ulrike Lucke holds the Chair of Complex Multimedia Application Architectures at the University of Potsdam since 2010. She obtained her diploma and her PhD in Computer Science at the University of Rostock. Besides different memberships in committees, she is vice-chairman of the German associations of CIOs in HEIs since 2016 and vice president of the German Informatics society since 2020. Her research interests include interoperability in heterogeneous socio-technical environments; mobile, pervasive and adaptive applications; and infrastructures for E-Learning, E-Science and E-Administration.

https://www.uni-potsdam.de/en/multimedia/team/ulrikelucke.html