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DIRECT ASSOCIATIONS OF THE TERMINOLOGY OF KNOWLEDGE TRANSFER – DIFFERENCES BETWEEN THE SOCIAL SCIENCES AND HUMANITIES (SSH) AND OTHER SCIENTIFIC DISCIPLINES

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Abstract. Knowledge transfer from universities to practical fields, policy, economy, and civil society is an issue of high relevance. However, the term itself is hardly used in a consistent way and only little research exists that elucidates the understanding of the phrase. To fill this research gap, we conducted a qualitative online study among Austrian university researchers. 283 participants from 18 universities were asked for a definition of university knowledge transfer and associated keywords. Qualitative Content Analysis revealed nine main categories of components: 'Science-to-public and science communication', 'science-to-science', 'science-to-professionals', 'education and teaching', 'exchange and mutual communication', 'knowledge transfer to economy and industry', 'knowledge transfer to people outside academic environments (not further specified)', 'moral obligations' and 'knowledge transfer to politicians and stakeholders'. Additionally, specific examples were mentioned and the complexity of the term was emphasized. Differences between social sciences and humanities (SSH) and other scientific disciplines could be detected in five categories.

Keywords: knowledge transfer, definition, qualitative methods, social sciences, humanities, university

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1. Introduction

The term '*knowledge transfer*' is commonly used, not only within scientific communities across different scientific disciplines, but also in political economy and public policy (Geuna and Muscio 2009). However, the term is hardly used in a consistent way. On the one hand, different scientific disciplines, as well as different non-academic communities, seem to interpret the term in different ways.

On the other hand, even within the same subgroup people have individual interpretations of what knowledge transfer stands for. This circumstance may lead to misunderstandings especially since the precise definition of what is being talked about is rarely specified. In scientific articles, for example, a reader will sometimes find a closer definition of what the article is about only in a subordinate clause. Thus, it appears that everybody knows what knowledge transfer means until someone asks for a definition. Within social sciences and humanities (SSH), this issue seems to be even more distinctive (Phipps et al. 2012). Furthermore, it is important to keep in mind that other phrases are used for the same or similar activities (Phipps et al.). Common examples include, for instance, 'knowledge dissemination', 'research utilization', 'knowledge management', 'knowledge mobilization', 'knowledge translation and transfer' or 'knowledge integration'. Some of these terms do imply specific goals, but can also lead to misassumptions.

1.1. First, second and third mission of university business

Nowadays the understanding of knowledge transfer is linked to the dedicated duties of universities and other higher education institutions. The question about the main goal of universities can be answered with one out of three possible options: '*teaching'*, '(*scientific*) *research'* or a combination of both. In fact, the order of these duties has originated from the development of the university system: educating students has been the primary goal while researching has been subsidiary. However, both domains are the most existential duties in university business (Trencher et al. 2014, Zawdie 2010).

Apart from these goals, other tasks are to be completed as well. During the last few decades the term '*third mission*' has gained more and more attention and importance in both research and public policy (Trencher et al.). It is used as a phrase that stands for responsibilities beyond the two main goals. Yet, just like 'knowledge transfer', its meaning has not been standardized and the term, therefore, is used inconsistently. Definitions range from ultra-short descriptions like "University–society synergies" (Sánchez-Barrioluengo 2014:1760), to complex characterizations that include "all activities concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments" (Molas-Gallart and Castro-Martínez 2007:321), and "activities related to research (technology transfer and innovation, etc.), to education (lifelong learning/continuing education, training, etc.), and to social engagement (public access to museums, concerts and lectures; voluntary work and consultancy by staff and students, etc.)" (E3M Project 2012:6), to give just a few examples of what different authors may understand, when defining universities' third mission. For a comprehensive overview of the field, see Laredo (2007).

When analyzing the different interpretations and domains of the third mission, three main components of third mission activities can be deduced: commercialization and exploitation of academically generated knowledge, utilization of theoretical knowledge, and knowledge transfer from universities into society and public policy.

When defining its first mission, a university may be tempted to focus on the first option. The struggle for budget – for example because of inflation and the cutback of public funding – often results in the search for alternative financial sources. The exploitation of research results gathered within the institution may be an effective way to earn money. This strategy includes patents, copyrights, and licenses, as well as the establishment of spin-offs. However, the amount of funding that can be raised is usually limited in almost every scientific discipline except for biotechnology and software engineering (Foray and Lissoni 2010, Laredo 2007).

The second option describes the search for (new) fields of application for theoretical knowledge. Research results are often not directly linked to specific problems in the field. As a matter of course, this applies for basic research in particular. Knowledge transfer may lead to the discovery of applicability of research results in both practical fields and other disciplines. This search is often driven by idealistic aims and can therefore give meaning to researchers. Besides, it is important to consider that researchers can also gain new insights from the fields of practice. By means of this reciprocal communication, both researchers and practitioners may benefit (Wutti and Hayden 2017). The process of knowledge transfer in search of fields of application may sometimes be combined with financial benefits as described above, but it is important to distinguish between a primary interest in the finding of usability of knowledge and the primary interest in earnings.

The last option has a different connotation from the first two and can be seen in some sense as a moral obligation or a civic duty. Universities play an important part in enlightenment and the raising of public awareness of scientific findings. On the one hand, decision makers in both practical fields and politics should base their decisions on the current state of scientific knowledge. It is therefore important for researchers to provide these stakeholders with required pieces of information (Riege and Lindsay 2006). On the other hand, it is part of the universities' duties to inform the public about the research that is conducted. In both cases, it is important to translate scientific terminology into everyday language, if necessary. Apart from the moral aspect of public information, universities, as governmental research institutions which are funded by the state, have to justify their economic and financial costs, not only to decision makers in politics, but also directly to taxpayers (Cherney et al. 2015, Landry et al. 2001).

1.2. Measuring knowledge transfer

For the past few decades, scientific research in the field of knowledge transfer has mainly focused on the collaboration between universities and both industry and economy (Geuna and Muscio). Common research questions in this field address the synergies of universities and firms, as well as the enhancement of technological progress and economic benefits. These issues are of particular interest to Science, Technology, Engineering and Mathematics (STEM), as well as medical and pharmaceutical studies (Laredo 2007). Even the documentation and measurement of university's achievements have been influenced by the focus on

university-industry cooperation. Thus, typical key performance indicators for knowledge transfer activities of universities are the number of patents, copyrights and spin-offs, as well as the connection to economy and industry (OECD 2013). Some of these indicators have actually been included in international multi-dimensional rankings for universities, like *U-Multirank* (www.umultirank.org). Other scientific disciplines, such as the SSH, however, have completely different scientific traditions that include different research purposes, different analysis procedures of research data and different strategies and objectives (Nederhof 2006, Olmos-Peñuela et al. 2014b). Additionally, the impact of research in the SSH is more difficult to elaborate (Olmos-Peñuela et al. 2014b). Therefore, a focus on profit oriented benchmarks for knowledge transfer is inadequate for the SSH and some other disciplines. It should generally be considered that this focus covers only a distinct segment of the comprehensive topic of knowledge transfer.

1.3. Illuminating the topic of knowledge transfer

As described above, knowledge transfer is a broad topic with different sub-domains and interpretations. Despite the importance of the issue and the common use of the term, only little research exists that elucidates the understanding of the phrase itself. In order to fill this research-gap, we investigated which subjects and activities university researchers directly link to the term knowledge transfer. We hypothesized that researchers would demonstrate a differentiated understanding of the term that includes different aspects apart from collaborations between university and industry/economy. Additionally, we were interested in whether specific subdomains would be more prevalent in specific scientific disciplines. To be specific, we analyzed whether differences between the SSH and other scientific disciplines can be detected.

2. Methods and design

We conducted a qualitative study as part of a bigger mixed-methods research project regarding knowledge transfer. We created an online questionnaire, using the *lime survey* platform (www.limesurvey.org). Invitations for participation were sent to each Austrian federal university that is part of the '*knowledge transfer center*' projects (*Wissenstransferzentren*; WTZ). The only inclusion criterion was current employment at a university.

2.1. Procedure

After general information about the purpose of the study, data privacy, and the distribution of the research results, participants were asked to provide some pieces of information about their current employment at the university and their fields of study. Following these questions regarding the subject's sociodemographic parameters, we requested a short definition of the phrase '*university knowledge transfer*', or, as an alternative, for keywords related to this expression. Except for

the information that the survey is dedicated to knowledge transfer, no other phrases or terms were presented to the participants before that question. In this way we avoided influencing the participants and could collect the direct deliberative associations (Felser 2015) that researchers link to the phrase knowledge transfer in the context of university research.

2.2. Data analysis

All the answers were uploaded to the online tool *QCAmap* (www.qcamap.org). We then used the *Qualitative Content Analysis* by Mayring (2014) to inductively form qualitative categories. Two coders independently coded half of the material, before the coding scheme was compared and discussed in order to create a consistent pattern of categories and subcategories. In the final step, all the answers were independently rated as a whole.

3. Results

3.1. Sample

283 participants from 18 different universities completed the survey. The sample is described in Table 1. As displayed, the majority of the sample was either at a PhD or habilitation level. Consequently, most of the participants described their current position as professorships or postdoc positions (56.5% of the sample). 32.9% were researchers in research projects, senior scientists, senior lecturers, or praedoc-assistants. 5.7% were working in universities' special departments and 4.9% did not specify their current field of work.

Table 1. Sociodemographic details of the study sample

Age	Mean:	45.05
	Std. Deviation:	11.88
Sex	Female:	127 (44.9%)
	Male:	144 (50.9%)
	No response:	12 (4.2%)
Level of education	Bachelor/else:	6 (2.2%)
	Master:	60 (21.2%)
	PhD:	98 (34.6%)
	Habilitation:	119 (42.0%)
Main field of research	SSH:	163 (57.6%)
	STEM:	68 (24.0%)
	Medicine:	16 (5.7%)
	Economy:	9 (3.2%)
	Else:	18 (6.4)
	No response:	9 (3.2)

SSH = social sciences and humanities; STEM = science, technology, engineering and mathematics;

More than half of the sample (57.6%) described their main field of research as part of the SSH. One quarter (24%) was working in the field of STEM at the time the study was conducted. The last quarter consisted of researchers in the fields of medicine, economy and other disciplines, as well as nine participants that did not specify their field of research.

3.2. Qualitative results

Results of our analysis could be divided into nine main categories. These categories can be labeled (in descending order in terms of frequency):

1. Science-to-public and science communication
2. Science-to-science
3. Science-to-professionals
4. Education and teaching
5. Exchange and mutual communication
6. Knowledge transfer to economy and industry
7. Knowledge transfer to people outside academic environments (not further specified)
8. Moral obligations
9. Knowledge transfer to politicians and stakeholders

Additionally, some participants mentioned certain projects or activities as specific examples. Others stated that it was difficult to find a definition of the term. Figures 1 and 2 display the frequencies of the main categories.

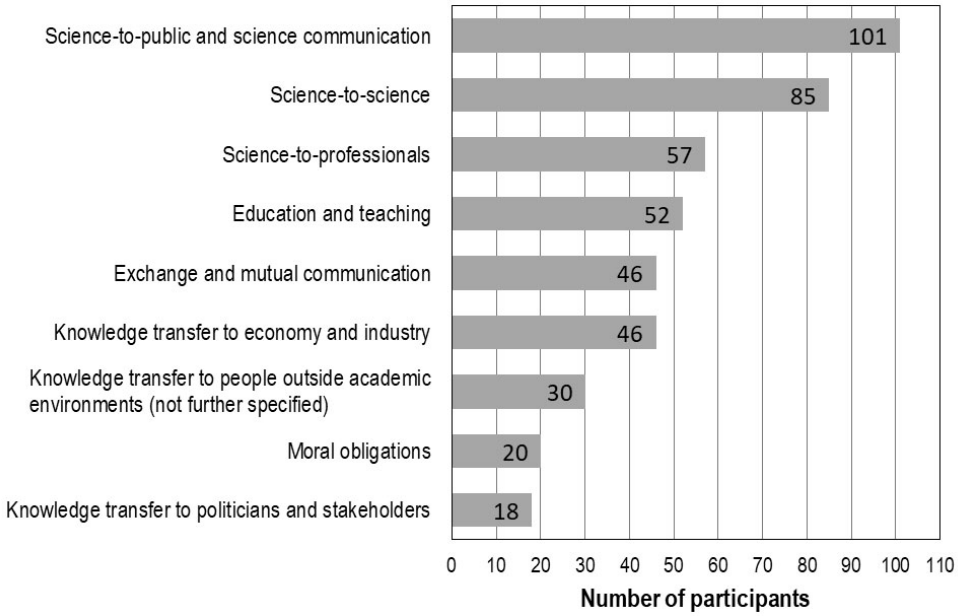

Figure 1. Number of participants who referred to the main categories.

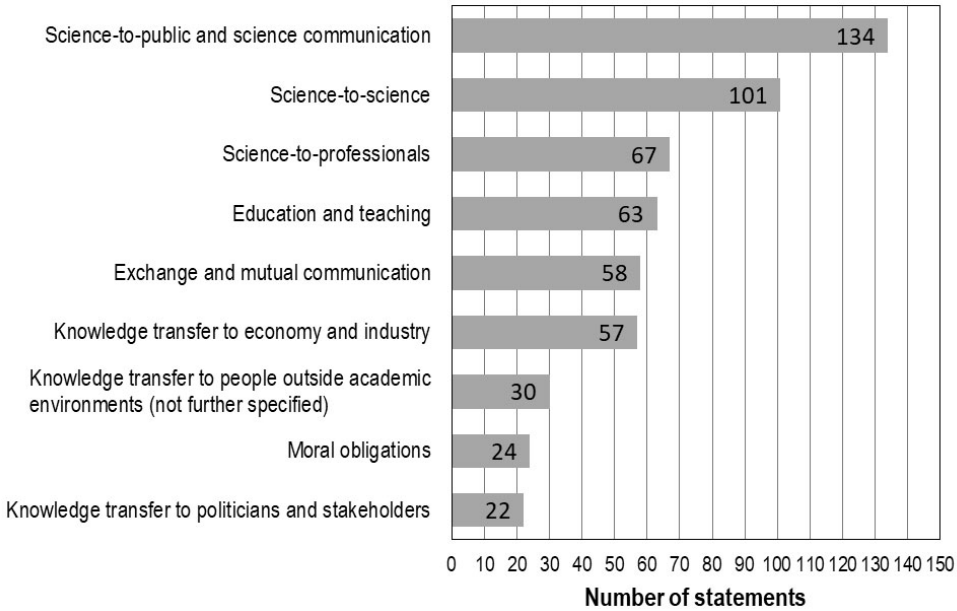

Figure 2. Number of statements that referred to the main categories.

3.2.1. Science-to-public and science communication

This category is defined by the communication of scientific results to the public. The process of science-to-public activities also includes the translation of complex research strategies and results in information understandable for non-professionals. The definitions contained explicit indications that knowledge transfer to interested individuals and parties, as well as to stakeholders in the public, would require adequate preparation and description of the whole research process. Excerpts from the transcripts quote that university knowledge transfer "reflects the interface between university and general public in a wider sense", bears "research knowledge to the center of society" or "prepares and transmits goals, contents, strategies, methods, results and meaning of current research activities to and for the public at large". Moreover, the phrase "science-to-public" itself was mentioned eight times.

The researchers mentioned that the field of public relations and communication of scientific research results is also directly linked to presence in the media, for example in newspapers or television. Strategies may include the authoring of contributions to popular media, the writing of commentaries in newspapers and magazines, or the attendance of science television shows. Participants of our study also frequently referred to the importance of knowledge transfer to civil society in order to satisfy public interest.

3.2.2. Science-to-science

Science-to-science activities can be defined as the heart of achievements within the scientific community. Science-to-science activities include the dissemination of scientific results in scientific journals or the presentation of results at conferences and congresses. Phrases used by participants in the study included "knowledge transmission from researcher to researcher", "communication of research results and evidence within the scientific community", or "consolidation and advancement of scientific results and their presentation in scientific papers and university education". Knowledge transfer was often defined as a combination of the transmission of knowledge within the scientific community and the transmission of knowledge to other parts of society, for example experts in the field or interested individuals and stakeholders in the public.

Of all the different quotes, two subcategories could be derived: knowledge transfer between different universities or research institutions, and knowledge transfer across different scientific disciplines. For the first subcategory definitions included "transfer and integration of explicit knowledge between different organizations", "combining research results, new insights, technologies, inventions, and know-how of different universities", or "exchange (potentially in both directions) of knowledge, data, competencies between universities and other research facilities". Furthermore, some statements referred to the importance of scientific networking, especially on an international level.

For the second subcategory, the buzzwords "interdisciplinary" and "transdisciplinary" were prevalent across the different statements. Examples included "transdisciplinary dialogue", "content-related exchange between different scientific disciplines", "multilateral cooperation with colleagues of different subjects within one university", or "interdisciplinary knowledge transfer, e.g. in a joint project of different scientific fields".

3.2.3. Science-to-professionals

This category refers to activities and communications with practitioners and experts outside the academic environment. It includes subcategories like 'cooperation between university and practical fields' or 'finding fields of utilization for research findings'.

Researchers frequently defined knowledge transfer as the process of transmitting knowledge to practical fields, for example "transfer knowledge that was created at the universities, directly to the people who need it [outside the research institutions]", or to "professionalized non-university structures, expert- or professional associations". Some participants stated that research results should improve working conditions and strategies of experts in the field. Others endorsed the idea of connections between theoretical and practical knowledge. Statements included for example "research in respect of practitioners", "connection between science and praxis", or "preparation and communication of theoretical perspectives and empirical evidence for professional praxis".

In general, a prominent part of the participants supported the idea of connections and collaboration between researchers and practitioners. Along with cooperation projects as prominent examples (e.g. "the exchange and collaboration (co-production and co-design) between science and partners in professional praxis"), subjects referred to the fact that knowledge transfer has mutual benefits for both sides. In this sense, knowledge transfer between research institutions and, for example, start-ups or practitioners was described as a reciprocal process of knowledge transmission rather than a one-way flux. Additionally, several specific processes were mentioned, like "cooperative reflection of the praxis", "practical research in terms of cooperative research of scientists and experts", or "professionalization, quality development". Other respondents also mentioned that universities might be adequate institutions to answer questions that had arisen in practical fields.

3.2.4. Education and teaching

In line with our previous findings (Wutti and Hayden), many participants mentioned education as a specific form of knowledge transfer. Most commonly, answers referred to education in universities and other higher education institutions. In this context academic training and the education of post-graduate researchers were cited as well. However, other statements referred to education in a broader sense that included education outside the universities, for example in schools or vocational training, as well as continuing education. Some participants explained that knowledge transfer is a mandatory part of each form of education.

3.2.5. Exchange and mutual communication

The issue of mutual exchange was commonly mentioned by the participants. Predominantly, researchers remarked that knowledge transfer is often not a one-way communication, but rather a mutual process. Both knowledge transfer within science and knowledge transfer with people or institutions outside the academic business is defined by exchange, networking and mutual learning, according to the participants. One person stated, "exchange would be the better phrase than transfer". Others suggested terms like "dialogue", "bridge", or "mutual comprehension".

In some cases, these bilateral or even multilateral processes were specified: Some researchers mentioned the transfer of knowledge and expertise from the public or professional fields into science. Others stated that research would benefit from feedback from outside research institutes. A total of five respondents noted the exchange of knowledge between teachers and students at university.

3.2.6. Knowledge transfer to economy and industry

As described above, research on knowledge transfer has focused on this subdomain for many years, yet in our study the total number of quotes that referred to this category was rather small. Researchers mentioned not only the transfer of

research results, but also cooperation with firms and businesses. Some referenced studies with the specific goal of innovation such as the search for better, cheaper or easier procedures for manufacturing. Consequently, the topic of exploitation is also relevant in this category. This includes patenting, licensing and university spin-offs. Excerpts from the answers include "transmission of insights to firms, institutions for specific technological or social adaption", "exchange of knowledge/know-how between different scientific and economic institutions", "collaboration between science and industry", or "the funded transmission of results, created at the universities, to a profit-oriented institution or company".

3.2.7. Knowledge transfer to people outside academic environments (not further specified)

Some respondents defined university knowledge transfer as the process of transferring knowledge from universities and research institutions to an audience outside the scientific world without defining specific targets, aims, or purposes. Many used the terms "a broader audience", "people outside the universities", "non-researchers", or "non-academic areas" to name the audience while the aims and purposes of this process were often entirely omitted.

3.2.8. Moral obligations

Researchers felt that knowledge transfer is a mandatory part of university business and of scientists' work. University staff should be aware of this social responsibility and should, therefore, take action to make research results popular. One example to achieve this would be by means of creative common licenses. Subjects stated that it is also necessary to demonstrate achievements of universities to the public. This is because Austrian universities are mainly funded by the state and the subject believed that taxpayers should have the right to receive a justification for the economic and financial costs they pay to governmental research institutions.

3.2.9. Knowledge transfer to politicians and stakeholders

Despite the fact that knowledge transfer to politicians and stakeholders is a topic of particular importance, only a few participants spontaneously connected this field to knowledge transfer. Those who did, however, confirmed the significance and referred to the communication of research results and conclusions to politicians, as well as stakeholders and agents in both the public and private sector. Examples from the study include "transfer of scientific insights to stake-holders in public and private sector", "co-production of societal relevant knowledge, together with non-scientific stakeholders", "consultancy and problem solution for [. . .] politics", or "supply and utilization of university knowledge and research for different groups of stakeholders". Similar to the category 'science-to-science', this category as well was often mentioned in line with other categories, like 'science-to-public' or 'science-to-professionals'.

3.2.10. Miscellaneous

Some statements could not be assigned to one of the categories defined above. Yet some issues that could be derived from these remaining statements are linked to two main assertions: First, it is important for researchers to 'leave the ivory tower' of academic fields. According to researchers, both research itself and the discussion and transmission of research results should be linked to other spheres of life. Secondly, knowledge transfer requires interest and can therefore only work out, if recipients (or conversational partners) are interested in scientific topics. Otherwise, participants stated, knowledge transfer would be condemned to fail.

3.2.11. Specific examples of knowledge transfer activities

Several participants mentioned specific activities relating to knowledge transfer. Most frequently, publications were mentioned as instruments for reaching out to people outside the universities. Some participants defined them more precisely as 'popular science'. In this regard, the topic of open-access publications was specified as well. Other approaches for knowledge transfer included conferences and workshops as well as scientific exhibitions. Additionally, participatory research approaches and research-oriented teaching methods were mentioned by the participants. Last but not least, some researchers referred to specific knowledge transfer events, like '*Lange Nacht der Forschung*', a nationwide event in Austria that makes current scientific research visible, or '*Kinderuni*', a project that is dedicated to introduce children to scientific study.

3.3. Comparison between the SSH and other scientific disciplines

At first sight, it seems as if the defined categories were evenly distributed across the different scientific disciplines. However, we conducted an independent-samples *t*-test for each main category to determine possible statistical significant differences between the SSH and the other scientific disciplines. For the analysis, we used *IBM SPSS Statistics* version 24. If *Levene's test for equality of variances* (Levene 1960) detected inhomogeneous variances in a category, the analysis of this category was adjusted by means of the Satterthwaite procedure (Satterthwaite 1946). Results of the *t*-tests are presented in Table 2.

As displayed, significant differences could be detected in five out of the nine main categories. Analyzing the results in more detail, it is obvious that researchers of the SSH were significantly less likely to implicitly link topics of exploitation or university-economy-collaborations to the term knowledge transfer, compared to researchers of other scientific disciplines. For the other four categories, researchers of the SSH were significantly more likely to establish a direct connection to knowledge transfer. Effect sizes (Cohen 1988), described by Cohen's *d*, can be labeled small to medium for 'knowledge transfer to economy and industry' and small for each other category.

Table 2. Results of the independent samples *t*-test for equality of means

	t-value	Degrees of freedom	*p*-value	Mean Difference	d_{Cohen}
Science-to-public and science communication	–2.184	269.673	**.030**	–.18615	.253
Science-to-science	–2.281	273.529	**.023**	–.15734	.262
Science-to-professionals	.650	281	.516	.04033	---
Education and teaching	–.167	281	.867	–.01053	---
Exchange and mutual communication	–1.109	251.9	.269	–.06458	---
Knowledge transfer to economy and industry	3.521	145.434	**.001**	.24089	–.489
Knowledge transfer to people outside academic environments (not further specified)	–2.027	277.989	**.044**	–.07066	.230
Moral obligations	–2.818	246.907	**.005**	–.09507	.294
Knowledge transfer to politicians and stakeholders	.142	281	.887	.00550	---

4. Discussion

The purpose of this study was the analysis of researchers' understanding and interpretation of knowledge transfer. By means of qualitative methods, we strived to elucidate which aspects and subjects are directly linked to the term. *Qualitative Content Analysis* (Mayring) revealed nine main categories. Additionally, some specific projects or activities were mentioned and other phrases were suggested as substitutes for the term knowledge transfer.

The category most cited was 'science-to-public and science communication'. 101 out of the 283 participants of our study made statements that could be attributed to this category. In line with previous research (Olmos-Peñuela et al. 2014b, Wutti and Hayden) this number appears reasonable. Science communication is an imperative part of university business (Nisbet and Mooney 2007) and the information about latest research results should, therefore, be a serious goal (Franzen et al. 2012). Considering the fact that laymen want to receive information directly from researchers themselves (European Commission 2013), a promotion of this aspect of knowledge transfer should be intended. Nevertheless, it is important to remember that researchers, especially at early stages of their career, may need support for these duties, for example in form of workshops or media training (Miller and Fahy 2010).

Surprisingly for the authors of this article, almost a third of the participants linked knowledge transfer to science-to-science activities. In the present study, interdisciplinary and transdisciplinary accomplishments were particularly emphasized in the sense of transferring scientific knowledge from one discipline to another. Additionally, the transfer of knowledge from one research institution to another was defined. It appears that researchers also connect knowledge transfer to the dissemination of knowledge to other researchers and not only to people outside

the universities. If the *third mission* of university business is not mentioned the meaning of the phrase seems to be widened. The high number of statements in this category indicates that knowledge transfer should not be reduced to the transmission of knowledge to non-university spheres. Very often, however, science-to-science activities were mentioned in combination with other aspects like science-to-public or science-to-professionals. Consequently inter- and/or transdisciplinary achievements should of course not solely be labeled knowledge transfer even though advantages of these research approaches are obvious (Brandt et al. 2013, Lang et al. 2012).

The first two categories were by far the most cited of the study (see Figures 1 and 2). Even 'science-to-professionals' was mentioned noticeably less frequently. Despite its importance (Wutti and Hayden), only every fifth participant linked this category deliberately to knowledge transfer. An explanation for that relatively small number may be that all the participants of our study were employed at universities. In Austria, the higher education institutions that are focused on training and continuing education of professionals are colleges. It may be that an inclusion of college staff may have proportionally increased the number of mentions in this category.

A similar amount of researchers that linked 'science to professionals' activities to knowledge transfer, connected topics of education and teaching. Apart from the issues of lifelong learning (Davis 2006), university teaching has also a great potential for knowledge transfer: Students transmit the knowledge they learned at higher education institutions to companies, firms and other spheres of society after their graduation (Landry et al. 2010). This process is often ignored in the scientific discourse about knowledge transfer, although its importance for both economy and society should be emphasized.

Several participants pointed out that knowledge transfer is determined by a mutual process that includes dialogue and exchange. This particular aspect has been well documented in other studies across different scientific fields (Graham et al. 2006, Mitton et al. 2007, Muthusamy and White 2005). Clearly, the transmission of knowledge from one institution to another requires communication and arrangements. As part of these procedures knowledge will flow in both directions rather than just unidirectional. In this way, universities can profit as well, for example, in the form of practical or new insights.

Obviously, exploitation of research results and the transference of knowledge to industry and economy was comparatively rarely cited by the participants. The quantity of statements did not even reach half of those from the science-to-public category and just a little more than half of those from the science-to-science category. When rating this result, it is important to keep in mind that most key performance indicators for knowledge transfer only display achievements in this category (OECD). Data from our study clearly indicates that the field of knowledge transfer is much broader and includes several other aspects that seem to be much more prominent and important to researchers.

Because we asked for a definition without any indication of what might be a part of this broad field it is hardly surprising that several participants specified the main characteristic, namely the transfer of knowledge. However, participants did not define any specific targets except for the fact that the knowledge that is produced and gathered at universities would be transmitted to a destination outside its own borders.

Less than 10% of the participants raised the topic of moral issues in connection to knowledge transfer. Even though this number appears nominal, it is important to remember that the primary task for the participants was to give a definition of knowledge transfer. Moral obligations may be seen as independent issues that are associated, but not directly part of the issue. Consequently, the moral component should be appreciated despite the small number of statements.

Consulting, as an effective way of evidenced-based decision-making in public policy and associated fields, is an important part of knowledge transfer. However, only few participants mentioned this topic. This duty is of particular importance in health services (Jacobson et al. 2005, Mitton et al.) and in the search for sustainable answers to global crises (Van Langenhove 2012) this duty is of particular importance. It may be that researchers think of consultancy as an independent process, rather than a subdomain of knowledge transfer. In the light of the small amount of responses, it appears advisable to raise the awareness of the importance of knowledge transfer to stakeholders.

4.1. Differences

We found statistically significant differences between researchers of the SSH and other scientific disciplines in five out of nine main categories. This indicates that SSH researchers may have a different understanding of what knowledge transfer stands for. They were more likely to link science-to-public activities and science communication topics directly to knowledge transfer. Answers more frequently included evidence of moral obligations. Additionally, researchers in the field of the SSH were more likely to describe knowledge transfer by the transmission of knowledge without any closer definition of the recipient. All of this indicates that SSH researchers interpret the term knowledge transfer in a broader sense and do not focus on one particular aspect. In consideration of the diverse range of duties of SSH researchers and the different audiences that are to be furnished with information (Nederhof), these results can be seen as expected . However, it is important to remark that the differences were only small in effect size. This would explain why disparities between the SSH and disciplines like natural sciences or engineering are inconsistent (Larivière et al. 2006).

Surprisingly, answers referring to science-to-science activities were also more common among SSH researchers. In our previous research (Wutti and Hayden), interviewees only focused on the other aspects of knowledge transfer and even excluded science-to-science activities. Other studies emphasize that knowledge diffusion in the SSH is often different from e.g. natural science (e.g. Larivière et

al. 2010). Again, it is important to point out the small effect sizes between the two samples.

Regarding synergies between universities and economy, researchers of other scientific disciplines were more likely to refer to the transmission of knowledge from universities to economy and industry. Consequently, collaborations between higher education institutions and firms, as well as the exploitation of research results were cited more often. This result, however, is not surprising in the light of previous studies (Olmos-Peñuela et al. 2014a, Phipps et al). Accordingly, the effect size of the difference between the two groups was greater for this category than for all the other categories. Nevertheless, it hardly reached the threshold of what can be labeled as a medium effect according to Cohen (1988). We, therefore, conclude that university-industry collaborations are not as relevant to scientists, as common benchmarks and quality criteria for knowledge transfer may suggest. In the light of these findings, we recommend broader and better-distinguished key performance indicators for university knowledge transfer that take the large spectrum of activities into account rather than focusing on synergies between universities and companies in economy and industry.

5. Conclusion

Most of the insights of our previous pilot-study (Wutti and Hayden) could be confirmed. We could demonstrate that both science-to-science and science-to-public achievements are of great importance to researchers and are directly linked to the topic of university knowledge transfer. Participants also evaluated teaching and educating of others – especially students – as being of great importance in this context. Additionally, data proved that researchers experience knowledge transfer as a mutual process with benefits for each side. However, we also found out that science-to-science activities are directly linked to the term 'knowledge transfer' especially in interdisciplinary and transdisciplinary contexts. University-industry/ economy collaborations were cited by both SSH researchers and researchers of other scientific disciplines. Nevertheless, this category was mentioned by only about 20% of the participants and significantly more often among non-SSH researchers. Topics of moral considerations or civic duties as well as topics of consultancy of politicians and stakeholders were prevalent, but not commonly mentioned in the current study.

Our results clearly demonstrate that knowledge transfer is a broad field that includes several different subdomains. Since most of these domains appeared to be more present in researchers' minds than only connections between research and economy or industry, we support the advancement of quality criteria for university knowledge transfer and recommend the development of more suitable benchmarks

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