IP Management in the triple helix context: Evidence from a German research project

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Introduction

Triple helix cooperation (THC) has become more and more popular worldwide in recent years. In Germany, for example, research partnerships between companies and universities or private research institutions have been growing by about 25 percent annually between 2002 and 2008 (ZEW, 2011). In such partnerships, universities usually provide 'fertile ground', i.e., researchers and infrastructure, whereas companies contribute 'seed', i.e., the money for undertaking research. Along such a partnership, both parties try to save as much of the 'harvest', i.e., the intellectual property (IP), as possible for their own use. One of the most important challenges of such research partnerships is hence related to the proper management of IP rights, which are created along the cooperation process. More specifically, the question arises whether and how balance can be achieved between different stakeholder interests in such projects and how such a balanced approach towards managing IP rights could be promoted through effective IP management. Based on case data and interviews from a German THC, this paper gives first insights how problems can be faced over the project lifetime and gives recommendation how challenges can be resolved and pitfalls can be avoided especially from a university's point of view.

Research situation in Germany

The scientific landscape in Germany is characterized by increasing expenses for research and development (R&D). In spite or even because of the economic crisis, the overall R&D expenses of the Federal Ministry of Education and Research have constantly been growing over the last 17 years at a compound annual growth rate of 4%, and of even 8% between 2007 and 2010 (BMBF, 2007, 2010). Overall, external funding of German universities, i.e., funding including both governmental and private funds, has been growing with an average rate of 7% over the last ten years (Statistisches Bundesamt, 2010). Despite these numbers, studies indicate a general tendency of decreasing basic funding (Geuna & Nesta, 2006) and increasing topic related competitive funding in most OECD countries (Leitner, Nones, Hölzl & Streicher, 2007). In addition to this, the number of private universities in Germany is rising (Statistisches Bundesamt, 2010). This development basically corresponds with developments towards privatized education in market-oriented countries such as the USA (Hall & Soskice, 2001). As a consequence, universities have to build up research competences that distinguish them from other competing universities and research institutes (Statistisches Bundesamt, 2009). Moreover, universities are forced to adequately market their "unique selling proposition" and to coordinate externally funded research projects as professional as possible. Amongst other challenges, universities have to cope with the management of IP that is created in research projects. Compared to professional service or industry firms, however, universities have made less efforts to build up and maintain strong capabilities in the management of their IP and, what is more, to take account of developing it further into profit-making patents.

State-of-the-art: Patent situation in German universities

Although most German universities are still publicly funded, new trends such as a growing number of private universities and a cutback of basic funding emerge and put public universities under pressure to professionalize their functions. This is necessary for keeping up with competitors for obtaining research funding. In the course of this, a further professionalization of functions such as patent and IP management or downstream technology transfer is warranted. Probably as a first result of such efforts, the number of patents of European universities has been growing in the last years (Geuna & Nesta, 2006). However, the number of patents assigned by European universities is still less compared to universities in the USA. In European countries, 60% of the patents assigned by a university belong to large-scale enterprises or big governmental funded research associations like Fraunhofer association. In Italy or France, for example, public-assigned patents owned by universities make just 10% (Lissoni, Llerena, McKlevey & Sanditov, 2008). This is different to the USA where faculties and universities own the majority of patents. There is no doubt that this was caused by the Bayh-Doyle-Act adopted in 1980, which allowed universities to patent and own IP. In Germany, it took over 20 years to attain a similar change by abandoning the "professor privilege". That is, until that time, professors enjoyed the freedom to assign patents to any juristic person and/or commercialize it on their own. Thus, patent rights were typically assigned to research sponsors rather than to universities (Geuna & Nesta, 2006). With this change of German law in 2002, professors adopted the same position as any other university employee, and the university itself became owner of all IP developed by its professors. As a result, patent applications by universities increased strongly during recent years (Geuna & Nesta, 2006).

However, while the mere number of patent applications increased, the quality of the patents decreased. Hence, a merely increasing number of patent applications cannot be seen as a general positive development per se (Henderson, Jaffe & Trajtenberg, 1998). As a consequence, the selection and application of patents – or, generally speaking, the IP – needs to be managed properly. Another reason for proper IP management is that usually only a few patents of the whole patent portfolio of an organization are valuable in terms of monetary or strategic profit (Ceccagnoli, Gambardella, Giuri, Licht & Mariani, 2005). Moreover, valuable patents occasionally require expensive legal defenses against competitors in order to strengthen their value and position. With this in mind it is questionable whether classical publicly funded universities in Germany can afford intensive patenting and expensive defenses. In many cases the financial background for a legal defense of patents is not given at universities (Singh, 2008). Nevertheless, the growing number of patents puts emphasis on the need for professionalization of processes and decisions on patentable inventions. Consequently, federal governments now more and more support and urge universities in strengthening their IP policies (Bruneel, D'Este & Salter, 2010) as well as regarding the protection and commercialization of their IP. This becomes visible in several appeals (e.g., Wissenschaftsrat, 2007) and initiatives (e.g. Chapple, Lockett, Siegel &Wright, 2005). In Germany, for example, by now over 20 agencies for helping universities and their technology transfer offices to commercialize patents emerged during the

last decade (Prognos, 2010). In addition to helping to commercialize and license patents, such agencies also help in founding spin-offs supporting further acquisition of new research cooperation.

Triple helix cooperation and their structure of partners

In the last two decades, a growing number of academic-industrial cooperation appeared. On the one hand, universities and other research institutions are more and more inclined to gather topic related funding by focusing on specific technological challenges from practice. On the other hand, companies are more and more open for sharing and multiplying their knowledge with academic support (Gassmann & Bader, 2006). In the course of this, the management of IP becomes an important success factor for R&D cooperation (Hertzfeld, Link & Vornortas, 2006). Furthermore, the proper management of IP becomes the more important the more partners are involved in R&D cooperation. With a growing number of partners, the multiplicity of interests grows and makes the management of the R&D cooperation more complex, often leading to high failure rates (e.g., Faems, Looy & Debackere, 2005; Link & Marxt, 2004). Therefore, the different partners and the general structure of multi-faceted triple helix cooperation have to be understood first before focusing on how IP might be properly managed in cooperation like this.

General sources of conflict of interests

In general, all of the partners aim at developing new basic and applied research results on a research subject commonly agreed on. But when it comes to the ‘motivation behind’, two groups can be identified: Universities and research institutes on the one hand and private funding partners on the other, whereas the funding ministry with its function of an initiator and supervisor plays a rather neutral role concerning IP issues. Additionally because of the Law on Employees’ Inventions all the inventions generally belong to the employer, i.e., a research institute, a university or a company. With the IP belonging to different partners with different focus and profit orientation, conflicts can arise.

On the one hand, the group of private partners seeks for IP as much as possible, no matter whether this is developed during the project or before. Ideally, the knowledge can even be used after the end of the project. An additional goal of this group of stakeholders is access to existing knowledge, data and results of all of the research organizations or even other private partners involved, especially if contact has not existed before. In contrast to the group of private sponsors, however, researchers are motivated to publish results and, by this means, to increase their reputation. The research organization itself, however, is motivated to protect the new knowledge even though the long-term goal is an overall transfer of the benefit to society. This securing and commercialization of knowledge represents not only financial income but especially the ability to present reputable research excellence to the industry (resulting, e.g., in more third-party funds) and the scientific community (resulting, e.g., in better recruitment opportunities).

Yet, the development of groups with different motivations does not necessarily have to lead to conflict or even failure of research cooperation. It is rather just a classic case of co-opetition: Organizations cooperate in R&D while making sure that the partners remain competitors in the market place (Porath, 2010), i.e., partners cooperate in research but compete in using and commercializing results and knowledge. Hence, the ownership and distribution of knowledge represent main challenges that need to be solved in research cooperation (Porath, 2010). One possibility is to define a strict set of rules during the first phase of cooperation's lifetime. In this paper, this shall be demonstrated by using data from a real case, which will be introduced in the following.

Methodology, Member profile and organization of an exemplary THC

In this self-observed study, we present case data from an exemplary research project funded by the German Federal Ministry of Education and Research for five years in a program to support innovative research partnerships in East German states. This exemplary character is based on the fact that we include almost all possible partners (Universities, semi-private research organization with non-profit character and private companies) to research cooperation except independent individuals. Numerous research projects are funded by the ministry within the same program for boosting the innovative strengths and economic success of the East German states by supporting top-level science and research but this is the only research cooperation including private companies. One of the aims of the project is to investigate management principles for these kinds of intersectional and interdisciplinary research cooperation. In addition to governmental funds, the project receives funding from four (one medium-sized and three big) private companies. The medium-sized company is international operating in upgrading lignite. Second is one of the three biggest lignite producers in Germany, also doing business as raw-material supplier and energy supplier. The two further companies are two of the four biggest energy suppliers in Germany running coal power plants amongst others. Among the recipients, there are two public universities and three research institutes. Two of these three research institutes are embedded in mother associations named Helmholtz and Fraunhofer. Both associations enjoy a basic public funding but are required to raise external funds. These associations host numerous specialized research institutes all over Germany, which operate considerably independent within the mother organization. Whereas Helmholtz association is more oriented at basic research, Fraunhofer association focuses more on applied sciences. The third research institute is an independent publicly funded research organization. Among the universities, one of the two is taking the lead and the spatial hosting of the research project.

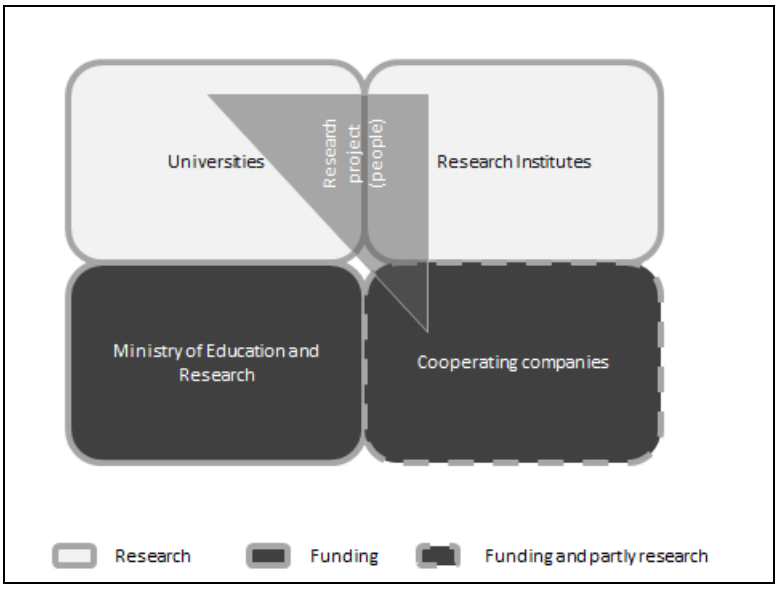

FIG.1: PROFILE OF MEMBERS IN A THC

As Figure 1 shows most of the people working on the project are researchers employed by two universities and embedded within specific institutes. The second group contains researchers from research institutes, and the third group researchers from the funding companies. These three groups (i.e., universities, research institutes and cooperating companies) and the Federal Ministry of Education and Research represent the core stakeholders of this research project. With this structure, the project includes nearly all kinds of partners a research cooperation can have (Hauschildt, 2004).

In contrast to the 16 other projects that are sponsored by the same federal program, the project at hand incorporates funding from private companies. This is reflected in the organizational structure and governance system of the project, which contains the following organizational entities:

- A board consisting of one representative of each funding company and of the dominating research organization as well as two professors of the hosting university, who also represent the speakers of the board.
- Two project coordinators referring to the two subject groups of researchers supervising the whole project. Their function is a connecting position between the board and the researchers, which includes reporting and information sharing with the board as well as sending annual reports to the supervising ministry.
- Subgroups and teams of researchers from universities and research institutes referring to the subprojects.

A special situation in the present case is the prominent role of the companies as co-sponsors of the project. Because of this company representatives are included in the board. Additionally, there are geographic distances between the researchers and there is more the virtual

character of the project. From an organizational point of view this can be seen as kind of a matrix organization type. One general problem is the legal difference of the partners, yet another is that the project is not independent from a financial point of view. The patents or other property rights – if they get assigned – belong to the mother organization the employee is working for, but not to the research cooperation. For this reason the institute's policy or rather the decision of the head of the institute defines the number of patents to be applied for. Legal reasons defend this to the point that property rights just can be owned by a juristic person, but not by a virtual project.

Findings and Interpretation: How to handle IP issues over the lifetime of THC

The following model aims to solve the question how to face IP issues arising in a research project especially from a university's point of view. The respective tasks project management has to cope with are structured into different phases along the lifetime of a typical THC. From the project at hand, three phases can be identified (see also Figure 2):

- (Pre-) start phase, which starts before the real project gets started;
- project phase, where elaborated strategies, policies and rules become implemented and realized;
- ending phase, which optimally takes place before the official ending of the project.

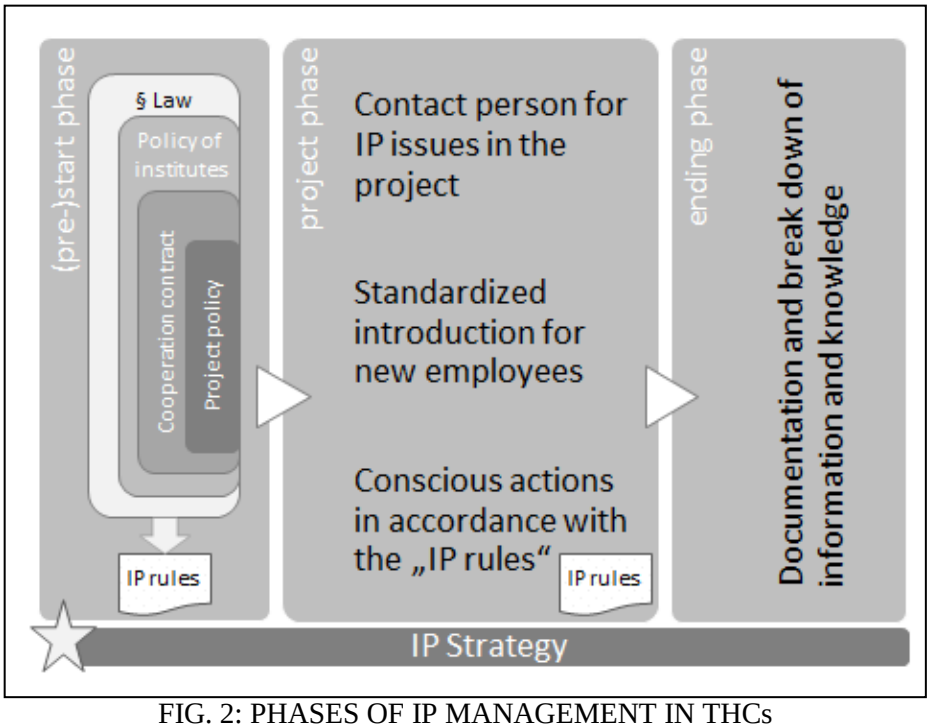

FIG. 2: PHASES OF IP MANAGEMENT IN THCs

(Pre-) start phase

The (pre-) start phase includes the beginning and even the time of pre-existence of a THC. In this phase, national and regional law sets the frame for the policies and strategies pursued by the initiating research institutes. These may become fixed in the cooperation contract once negotiations among the parties involved are finished. Based on the cooperation contract, project policies including IP strategy and management measures are outlined and may become aggregated in a project handbook or specific "IP rules". As a matter of fact, project-related IP rules set transparent guidelines for researchers in a specific research project. The earlier this (pre) start phase is finished and the guidelines are set, the less project time will have passed leaving space for actions which are not in accordance with the guidelines. The constitutive character makes this phase a very important phase of a project. More specifically, in the beginning of a project, some of the conflicts that may possibly emerge during later stages can be avoided by fixed policies and rules that are in line with national and regional laws, that are aligned with the policies of the involved stakeholders, and that are commonly agreed on resulting in a cooperation contract. After fixing this contract the remaining space can be used for project related policies and strategies (see Figure 2). In the following, some possible strategies concerning the negotiation of a cooperation contract will be presented.

Possible strategies for negotiating a cooperation contract

One of the major difficulties when negotiating a cooperation contract is to define solutions for eventually appearing situations which are not foreseeable at the point in time of negotiating and signing the contract. Especially policies regarding the handling of the contributed and resulting data and knowledge have to be clarified in a cooperation contract of research cooperation. In the present case, good practice contracts were used as model contracts which were adjusted to the respective research project.

A tender point in cooperation contracts are clauses which demand a prior agreement before publishing scientific results. This often comes into conflict with time aspects and the personal interests of researchers (Bruneel, et al., 2010). Whereas scientists are interested in prompt publishing in order to improve their scientific reputation and placing the outputs of research into the public domain is one of the requirements of public funded research activities (Smith, 2001), funding companies are more interested in secrecy and protection of the results and discoveries.

However, entering new cooperation contracts might also bear advantages for universities by offering the chance of becoming "relived" from existing concessions with private partners in former contractual agreements. By this means, the cooperation contract is embedded in the existing (social) environment of a university (Blumberg, 1998). So no negotiation can be undertaken isolated from former negotiations. Existing agreements and concessions in former research contracts are taken as a starting point for the new negotiations. If now changes to existing arrangements are made they can be considered as signal for mistrust. In the worst case

this could provoke disclosure of information and knowledge transfer. So, negotiations in this field are very challenging and influencing the future work. But there can be a way to solve this challenge in an elegant way with recruiting new partners in a THC.

For example: research institute A has an existing project with scope S1 with company X. The cooperation contract includes concessions that grant X deep insights to A's results. Now institute A wants to start a new cooperation project with scope S2 and to once again recruit company X as funding partner. In this situation institute A has a hard negotiation position if A doesn't want to grant as much insights to the results of S2 as for S1. If now institute A additionally finds a new research partner B for research project S2, a new partner is included into the negotiation process. As in general a cooperation contract is a general contract signed by all involved parties, the positions of A and B are equal. In the ideal case the new partner B has no historical contractual background with company X. Now B can start the contractual negotiation from a neutral position and improve the concessions for project S2 from A's point of view, too. The motivation for A to include B is the improvement of the arrangement with company X, whereas the motivation for institute B is the participation in a new research project. The stronger the strategic importance of B, the stronger is the negotiation position of B and the stronger can be positive spillover effects for A. So, including new cooperation partners can potentially improve the contractual situation with cooperating companies from a research institute's or university's point of view.

Another aspect that suggests inviting new research partners is learning. Almost every research organization brings model contracts into new research cooperation, but in many cases those contracts have to be adjusted. Hence, building on the existing experience and expertise of other research institutes might be profitable. This can help saving time and accelerating the money transfer from the funding partners involved to the research institutes: In the case at hand, no money transfer from the ministry or the involved companies had taken place until the cooperation contract was signed. This issue can become very important if the money transfer is related to expensive research investments that are important for delivering research objectives in time. In our case, the purchase of a research instrument got pushed back because of the late contract signing and money transfer. This led to a delay in research gauging and caused a push back for downstream subprojects that build on the results of the analysis of more than six months. This is just one example of how late contract signing may risk the success of a whole research project.

Possible IP Strategies for the THC

With setting a cooperation contract the question for an IP strategy arises. More specifically, "[p]atent strategy for a technology area is the science and art of managing research to meet competitors in the marketplace under advantageous conditions." (Knight, 2007, p.70) If the marketplace is limited and most of the players are cooperation partners it has to be made clear what kind of patent strategy partners are looking for. According to Harhoff (2005),

different IP strategies have to be considered when setting the stage for an industry project. In the following, these strategies will be evaluated as for their applicability for a THC:

- Intensive application and active defending: This strategy would be of interest in order to strengthen the position in the technological field. Building barriers discourages the entrance to a certain technology area. With numerous costly applications and especially costs of a legal action the costs are very high and usually overcharge the possibilities of universities. If there is no big budget planned and part of the project the realization of this strategy is questionable.
- Patent nets: This means building nets with further patents around own patents or restricting the base patent of a competitor with the net. Again, the costs for the numerous necessary applications are heavy and usually public organizations do not have a budget for fulfilling this strategy.
- Patent maze: This implies assigning patents which are interwoven with closely related patents. This density raises – akin to the related patent net strategy – the security and therefore the strength of the base patent. As before, all strategies which include the application of numerous patents get expensive and, again, this depends on the budget.
- Patent flooding/blanketing: In this case the technology area is flooded by a tremendously high number of patents at one moment. This requires a very high effort and coordination in a short moment of time as otherwise the patents could be used as a source of information for competitors. As this strategy is not only costly but also time consuming, the appropriateness of this strategy for a public university is nonrealistic as well.

To sum this up, all named patent strategies are expensive and more or less time consuming so that conditions to apply the strategies can barely be fulfilled by a public university. In the present case, for example, there was no budget reserved for patent applications at all. What remains for the project itself are strategies with a more “silent” character (Gassmann & Bader, 2006):

- Secrecy: This means keeping the results disclosed in the organization. This however is absolutely contrary to the general goal of a university aiming at doing research for some social benefit.
- Publishing: This includes publishing new results and knowledge in order to set the standard in the technology area. This brings prestige and additionally prevents patent applications of competitors with setting the standard. Hence, this strategy would be most suitable for a university. However, as some of the researches as well as some of the private partners in a research cooperation project are heading for some patents at the end of the day some individual patents will be at least assigned. In these cases, researchers and especially project coordinators as well as an IP person in charge at the mother organization have to decide how to select and time patent applications. This will be detailed in the following section of the paper.

Project phase

After setting the frame for a proper handling of IP issues within a THC, this frame has to be actively used when making IP decisions. This takes place in the project phase, which embraces the biggest part of the project lifetime. There are especially three important points that have to be considered. First, a person has to be defined for acting as a contact person for all IP related issues and for documenting the results. This person has two main functions: Acting as an information desk and as a "sponge". On the one hand, this person should have a possibly neutral position and should be a confidential person. It can be a dual position in combination with the role of a project coordinator. This person should work as a contact person for all IP related questions and should assist the inventor. On the other hand, the IP person should adsorb all IP related know-how like a sponge and should disperse this knowledge whenever needed. The position of the IP person should best be backed with the necessary authority by the project leaders.

Second, there has to be a standardized introduction (document, presentation, etc.) for every new employee as part of the formal integration process. "IP rules" could be this kind of onboarding document. Third, all actions taken within the project should be in accordance with the IP rules. This last part is most difficult and requires the support especially from the project management team as sticking to the rules becomes the more efficient the stricter the leaders act in accordance with the rules and become "role models". This could also be improved by further educating the project coordinators in IP related topics.

Ending phase

It is difficult to fix a concrete point in time when the ending phase starts. In general, the more suitable the documentation of results, data and knowledge the easier this phase turns out to be. There are two major challenges that have to be managed: First, the agglomeration of the results and knowledge, and second their documentation and transfer, respectively. These two steps optimally have taken place during the previous project phases, too. But towards the end of a project this is a "must".

In the course of this phase, the results of the project are summed up as a whole. This means bringing together all reports, databases and further scientific findings down to one master piece, report, etc. The results that will be handed over to the partners have to get defined by the project coordinators so that the final knowledge transfer can take place. From a mere "transfer" point of view it would be advisable to just deliver suitable results to the partners. License incomes can be a nice side benefit for the mother organization.

Another important step is to document the results. As a project itself always has a temporary character by definition it has to be made sure which organization will keep what kind of result. This can be done by the leading institute alone or by the participating partners, which

then keep the relevant results within their institution. This would be the case in the project at hand as this was fixed in the cooperation contract.

Additionally, this phase can also initiate applications for follow-up support of the present THC or for elaborating new project ideas out of the new findings. In the case of a follow-up support this ending phase runs parallel to the new (pre-) start phase of the next project life-cycle.

Conclusion, Policy Implications and Directions for Future Research

By drawing an overall picture of the research situation and the patent situation at German universities and by providing practical evidence from a real case, this paper seeks to close the gap of providing practical advice for research managers in THC. More specifically, the phase model that we created along the lifetime of a real project shall help research coordinators in managing IP concerning issues. In addition, the structure of partners, interests and 'motivations behind' of a real THC are presented to show possible means for successful contract negation and IP strategies to be adopted in day-to-day IP management practices. Despite of critical views that mainly see universities as contributors to society (Smith, Parr, 2005), others that admit universities to derive extra income from patenting (Geuna & Nesta, 2006) exist as well. In sum, our paper suggests that both roles universities can play can be realized synergistically by adopting appropriate IP management measures.

Nevertheless, our paper as every other has limitations, too. One is that we solely analyzed companies' role as sponsors whereas it is also possible that company partners are just loosely participating in a THC, for example, by announcing a letter of interest. Hence, further research should be conducted for cases that contain cooperating companies which do not participate in funding. Another limitation is the fact that the project at hand is still running and that for this reason no statements can be derived for the ending phase yet. As a consequence, further insights into the management of IP at the end of a project needs to be conducted and compared by future research.

Moreover, there are different roles a research coordinator or manager (Kirkland, 2005) can play. In the present case the THC coordinator is just responsible for the project at hand, i.e., he is not formally involved in the making of institutional research policies but is involved in their implementation. It would be worth investigating IP management implications for the case of a THC coordinator who additionally plays one of the other roles as defined by Kirkland (2005): role as a 'leader' (person who has the authority to make institutional policy), as a 'member' (senior research manager who makes policies alongside academic colleagues in key committees) or as a 'secretary' (research manager who may have token representation on key decision-making committees but their main involvement comes through the provision of advice, reports and data).

This paper has hence to be seen as a starting point for further research. The specific setting of the longitudinal case presented here has to be challenged by other evidence and should be captured in propositions that need to be tested quantitatively.

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