

WIN-WIN-WIN FOR INDUSTRY, RESEARCH AND INDIVIDUALS: SUPERVISORS' INSIGHTS FROM THE TANDEM PROGRAMME AT TH KÖLN

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Abstract

The tandem programme at TH Köln is a five-year dual qualification programme in which participants are simultaneously employed by a partner organisation and by TH Köln as doctoral student or postdoc. This study investigates the roles of academic and industry supervisors, the perceived benefits and costs of the tandem programme, and collaboration among stakeholders. Social Exchange Theory (SET) is used to examine how supervisors evaluate the benefits and costs of collaboration. Semi-structured interviews were conducted with 20 supervisors from academia and industry who oversaw 23 doctoral and postdoctoral researchers in the programme, several of whom had participated since 2022. The findings revealed a broad spectrum of perceived roles, benefits, and approaches to collaboration. Win-win-win scenarios were analysed alongside suggestions for minimising costs and maximising benefits. The study underscores the importance of supervision quality and outlines best practices for guiding future tandem collaborations that advance flexible career pathways and support the achievement of the 2030 sustainability goals.

1 Introduction

The 2030 Agenda for Sustainable Development emphasises the importance of fostering strong connections and collaboration between industry, research, and policy to drive meaningful and positive societal change (United Nations General Assembly, 2015). In alignment with these global objectives, the tandem programme at TH Köln exemplifies a practical approach to bridging academia and industry and fostering collaboration that supports sustainable innovation and professional development.

1.1 The context of the tandem programme

The tandem programme at TH Köln is a dual qualification programme that fosters ongoing collaboration and knowledge exchange between research and industry by enabling participants to hold dual employment for up to five years: an industry position alongside a doctoral or postdoctoral

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research position. During this period, participants are supported by supervisors from both academia and industry*. Participants are expected to gain valuable teaching and applied professional experience alongside their research, thereby building a skills base for work in industry, the public sector, or research, including a pathway to a professorship at a university of applied sciences. The programme is designed to remain open in terms of outcomes, enabling participants to decide in favour of an industry career as an alternative pathway. As a result, the programme encourages more flexible career pathways.

The tandem programme is a subproject within the broader P_{LAN}_CV initiative, which supports academic personnel development at TH Köln. P_{LAN}_CV is a German acronym that translates as “Rethinking Professorial Careers at Universities of Applied Sciences”. Funded by the Federal Ministry of Research, Technology and Space (BMFTR) and the Joint Science Conference (GWK) (Funding reference number 03FP09), P_{LAN}_CV aims to strengthen career pathways towards professorships at universities of applied sciences. It aims to achieve this goal by broadening the pool of qualified candidates and enhancing their competencies. Anticipating a large number of professorship vacancies at universities of applied sciences in Germany by 2030 (In der Smitten et al., 2017), the initiative adopts a holistic approach that addresses multiple stages of the academic career life cycle, from student research assistants through promotion, postdoctoral qualification, to professorship, while integrating cross-cutting themes such as diversity, high-quality supervision, and career development across its five coordinated subprojects.

As one of the five P_{LAN}_CV subprojects, the tandem programme was guided by a Trias principle developed specifically in the TH Köln context. The term “Trias” stems from the Latin word meaning “a group of three,” referring here to the three core academic missions: teaching, research, and transfer (Szczyrba et al., 2025). The Trias principle emphasises that teaching, research, and transfer are closely interconnected and should actively support and enrich one another, rather than being treated as separate or competing responsibilities of a scholar (Hausstein et al., 2022). Inspired by Boyer’s influential critique (1990) of the traditional focus on research output alone as the main measure of academic success, this approach calls for recognising teaching and meaningful engagement with society and real-world problems as equally vital components of scholarly work. At TH Köln, the Trias principle forms a foundational part of the tandem programme (Szczyrba et al., 2025). Supervisors and participants alike are introduced to this concept, which encourages them to embrace their multiple roles as researchers, educators, and practitioners and to see these roles as mutually reinforcing.

In this article, we examine the tandem programme from the perspective of supervisors at both the university of applied sciences and the partner organisations. Using interview data, we focus on how supervisors describe their roles, what benefits and costs they perceive in the tandem programme, and how collaboration between the two settings is shaped.

1.2 Supervisors’ roles and quality of supervision

The supervisor’s role has been described as central to a candidate’s success in academia as well as in an industry workplace environment. Academic supervisor support has been reported to be associated with lower drop-out rates, better academic performance, and improved well-being (Kunz et al., 2021; Ringo, 2025; Wollast et al., 2023). Academic supervisors can facilitate networking, provide support in times of difficulty, offer intellectual input and relevant information (Jaksztat et al., 2021; Mainhard et al., 2009; Skopek et al., 2022). Similarly, high-quality industrial supervision correlates with lower attrition rates, better job performance, higher job satisfaction, and well-being (Herawati et al., 2023; Mohr et al., 2021; Zeb et al., 2023).

Given the importance of the supervisor position, prior research has attempted to analyse supervisors’ roles and examples of exemplary and flawed supervision, sometimes providing a handbook as a guideline for doctoral supervision (Taylor & Kiley, 2024). To understand the aspects of the academic supervisor’s role, an extensive international study identified clusters of meaning associated with that role (Guarimata-Salinas et al., 2024). The authors provided a list of 18 functions

* In this article, the term industry supervisor or industry partner is used broadly to refer to all partners involved in the tandem programme who are situated outside academia, including public, private, and non-profit organisations. Academic supervisor refers to the university supervisor from TH Köln.

of a supervisor, including supervising, directing, guiding, leading, managing, advising, and mentoring. They also refer to the Sapir-Whorf hypothesis, which states that language affects perception and behaviour. Accordingly, the way supervisors linguistically frame their role may shape their approach to supervision. One more study investigated the role of workplace supervisors in the context of work-integrated learning (Fleming et al., 2021). The authors argue that supervisors have an educational role in helping students acquire skills such as software knowledge, digital office skills, understanding workplace expectations and culture, communication, problem-solving, critical thinking, and professional behaviours (work ethic and networking, etc.).

Some studies have investigated styles and types of supervision. Deuchar (2008) applied four supervision styles to analyse doctoral supervision: *laissez-faire*, where the supervisor largely observes and allows the candidate to independently manage both research and personal progress; *pastoral*, in which the supervisor provides mainly personal and emotional support while expecting the candidate to manage their research; *directorial*, characterised by active and structured guidance focused on managing the research process; and *contractual*, where supervisor and candidate negotiate the extent of academic and personal support needed throughout the research journey. The author emphasised that these styles should be adapted and combined flexibly to suit the candidate's changing needs and context rather than applied rigidly. In a qualitative study, Reis and Szczyrba (2011) outlined the following types of doctoral supervisors: (a) fatherly friend and group moderator, (b) teacher with therapeutic ambitions, (c) boss and evaluator, and (d) guide in self-realisation processes. The authors emphasise the importance of ensuring the quality of supervision and, as an example, suggest a two-day workshop in which supervisors can reflect deeply on their roles and develop an intentional course of action. However, they underscore that such a one-off workshop is not sufficient. Rather, supervisors need to participate regularly in ongoing professional development to maintain and enhance their supervisory skills.

Indeed, the issue of supervision quality has interested a number of researchers, as Motshoane and McKenna (2021) wrote: "crossing the border from being a doctoral candidate to becoming a doctoral supervisor entails significant shifts in identity and an understanding of postgraduate pedagogy and institutional expectations" (p. 1). They also underline the need for opportunities for supervisor development.

Another aspect to consider in the context of the tandem programme at TH Köln is communication between supervisors, since doctoral and postdoctoral candidates have two supervisors from the university and industry guiding them. When supervisors jointly develop a shared understanding of the processes in research, teaching, and transfer, uncertainties for doctoral candidates are minimised (Müller-Otto & Szczyrba, 2025). When left alone with this task, their uncertainties grow. Thus, strong collaboration between supervisors is essential to support candidates in their transdisciplinary work.

1.3 Social Exchange Theory: Costs and benefits of supervision

Social Exchange Theory (SET) applies economic principles of cost-benefit analysis to social relationships, suggesting that individuals engage in interactions much like transactions in which they seek to maximise rewards and minimise costs. People tend to maintain relationships that provide greater benefits than costs and may end those where the costs outweigh the gains (Emerson, 1976). Initially focused on one-to-one exchanges or dyads (Blau, 1986; Homans, 1958), the theory was later expanded by Emerson (1976) to encompass broader networks involving multiple actors. These exchange networks show how exchanges connect many people, creating systems where resources and influence flow across social ties. This broader view highlights the importance of collaboration through so-called productive exchange, where several actors work together to create greater value. Instead of simple trade, *productive exchange* involves joint efforts leading to outcomes that are magnified through cooperation. What Emerson described is closely related to the idea of synergy effects, when the combined efforts produce a result greater than the sum of individual contributions (Klimuk et al., 2020).

SET has been used as an underlying theory in a number of works on supervision relationships in workplace contexts (Zeb et al., 2023) and academia, including research on doctoral (Fan et al., 2019) and postdoctoral (Karalis Noel et al., 2022) levels. Zeb et al. (2023) have differentiated

between extrinsic and intrinsic rewards that employees receive in a workplace setting. While extrinsic rewards are mostly monetary, intrinsic rewards include, for example support and appreciation from the supervisor, which have been found to lead to better performance. In the academic setting, doctoral researchers have been shown to provide greater benefits in the form of innovative ideas and creativity when they perceive support from the supervisor (Fan et al., 2019). In line with prior research, the authors also emphasise that when each stakeholder sees value in the exchange, this positively affects reciprocity within the social exchange. Regarding the relationship between supervisor and a postdoc, prior research states that this relationship is not unidirectional, as previously assumed, with the mentor extending benefits to the postdoc, but rather, in accordance with SET, bidirectional. A postdoc may benefit the supervisor, the field of research, or other graduate students. Postdocs reported they appreciate regular meetings with supervisors, clear communication on roles and expectations, and conversations on their research and career goals (Karalis Noel et al., 2022). In sum, prior research has shown that SET has been applied to reciprocal supervisor-supervisee relationships, and has shown that the collaboration was more effective when the perceived value of the exchange was high. These findings confirm the value proposition of SET, which states that perceived value drives commitment and willingness to maintain a relationship (Emerson, 1976).

The tandem programme offers a compelling context for applying SET because it operates within a multi-stakeholder supervision model. Unlike traditional dyadic supervision, the tandem structure distributes resources, responsibilities, and potential costs across three parties: the doctoral or postdoctoral candidate, the academic supervisor, and the industry supervisor. Examining this triadic form of supervision is particularly important given the increasing prevalence of programmes involving industry-academia collaboration. SET provides a useful framework to understand how these stakeholders evaluate the costs and benefits of their involvement and how perceptions of reciprocity affect the quality and sustainability of their collaboration. Applying SET to the tandem programme allows us to analyse supervision dynamics within this complex exchange network and investigate how the perceived value of exchanges shapes collaborative outcomes.

1.4 Study objectives and research questions

The overall objective of this study was to identify, from the supervisors' perspective, the success factors within the tandem programme, so that future dual qualification programmes can benefit from these insights. The decision to focus on supervisors' perceived roles is based on their central importance: supervision quality critically influences the success of such programmes, and prior research emphasises the need to understand how clearly supervisors comprehend their responsibilities. Exploring the benefits and challenges experienced by both academic and industrial supervisors offers a balanced view of this dual qualification pathway, considering the perspectives of all stakeholders involved: academic supervisors, industrial supervisors, and tandem participants. Finally, examining collaboration seeks to uncover what has proven effective within the supervisory triads, allowing future dual qualification programmes to build on these successful practices. We therefore pose the following three research questions:

- RQ1: How do supervisors perceive their role within the tandem programme?
- RQ2: What benefits and costs do academic and industry supervisors experience in their tandem supervision set-up?
- RQ3: How do supervisors describe their collaboration with the tandem participants and partner organisations?

2 Methodology

Since the start of the project in 2022, a total of 23 doctoral and postdoctoral researchers with different start times have participated in the tandem programme. While doctoral candidates' full-time positions are divided similarly between the two employers (mostly 40% at TH Köln and 60% at the partner organisation), the postdocs are predominantly employed by the partner organisation (mostly

80%) and the remaining time at TH Köln (mostly 20%). Six tandem employees ended their tandem employment before the programme ended, for example, after completing their doctorate or because they transitioned to another job. 17 tandem employees were employed in the tandem programme at the time of the supervisor interviews. Of these, nine were doctoral and eight postdoctoral researchers employed simultaneously at TH Köln and a partner organisation. 11 of the 17 tandem employees worked in the industrial sector, one in finance, one in construction, one in culture, one in the non-profit sector, and two in the public sector. Accordingly, there were nine tandem employees at the Faculty of Computer Science and Engineering Science (F10), one at the Faculty of Automotive Systems and Production (F08), one at the Faculty of Process Engineering, Energy and Mechanical Technology (F09), one at the Faculty of Civil Engineering and Environmental Technology (F06), 1 at the Faculty of Business, Economics and Law (F04), one at the Faculty of Information Science and Communication Studies (F03), two at the Faculty of Cultural Studies (F02), and one tandem employee at the Faculty of Applied Social Sciences (F01).

Stakeholders in the tandem programme signed the relevant agreements: the supervision agreement for doctoral candidates, the agreement on developing an individual career profile for postdocs, and the cooperation agreement between TH Köln and partner organisations. These agreements included roles and responsibilities of the parties involved and suggested a structure of collaboration. The agreements specified clear timeframes and work plans with milestones and called for regular meetings: several times a year for doctoral candidates and at least once a year for postdocs, bringing together academic and industry supervisors to review progress and refine objectives as needed. Academic supervisors focused on academic guidance, fostering scientific independence, and supporting career development in research, teaching, and practice. Industry supervisors provided professional mentoring aligned with applied research and industry perspectives. Both supported conference participation, publication activity, and skills development.

All supervisors of the tandem employees from both organisations (TH Köln and the partner organisation) were invited by the project lead by email to participate in an interview. The purpose of the interviews for evaluation (e.g., identification of roles) was communicated transparently. Several supervisors subsequently responded and agreed to participate (14 professors and 6 non-academic partners). Because one professor supervises three tandem employees, almost all TH Köln professors could be reached. Written informed consent, including consent to record the interview, was obtained. The interviews were conducted between October 2024 and January 2025 using videoconferencing software (ZOOM) to minimise the effort required for voluntary participation. A semi-structured interview guide was developed for both professors and non-academic partners, with most questions remaining consistent across both versions (see Appendix A for the interview guide with specific questions).

With the interviewees' consent, the first interviews were conducted jointly by two interviewers (the second and third co-authors) to ensure a consistent interview approach. The remaining interviews were randomly assigned between the two interviewers. The average interview length was 51 minutes. After each interview, a postscript was written to document disruptions, initial impressions, and emerging ideas for interpretation.

The interviews were recorded and transcribed by the transcription service provider "Buero24". Thereafter, the interviewers created a coding scheme informed by the theory and the project goals. The first two interviews were double-coded in MAXQDA. After discussions about the disagreements, the establishment of clear coding rules, and the refinement of the codes, a 100% intercoder agreement was achieved. Following the finalisation of the coding scheme, the remaining interviews were subsequently coded individually. The interview transcripts were analysed in order to explore supervisors' perspectives on success factors within the tandem programme. Specifically, three thematic codes reflecting the study's objectives and research questions were applied: "perceived role" (RQ1), "benefits" and "costs" (RQ2), and "collaboration" (RQ3). Finally, the codes were analysed according to the principles of qualitative content analysis by the first author of this article (cf. Mayring, 2008). The interviews were translated from German into English using TH Köln ChatGPT.

3 Results

Our analysis revealed that the implementation of the tandem programme varied considerably depending on the constellation formed among a given tandem participant, industry supervisor, and academic supervisor. The results reflect a spectrum of implementation regarding perceived roles, benefits and costs, and collaboration within the programme.

3.1 Perceived roles

Supervisors' perceptions of their roles varied. These included, for example, roles such as coach, mentor, adviser, and sparring partner. Figure 1 provides an overview of the roles mentioned.

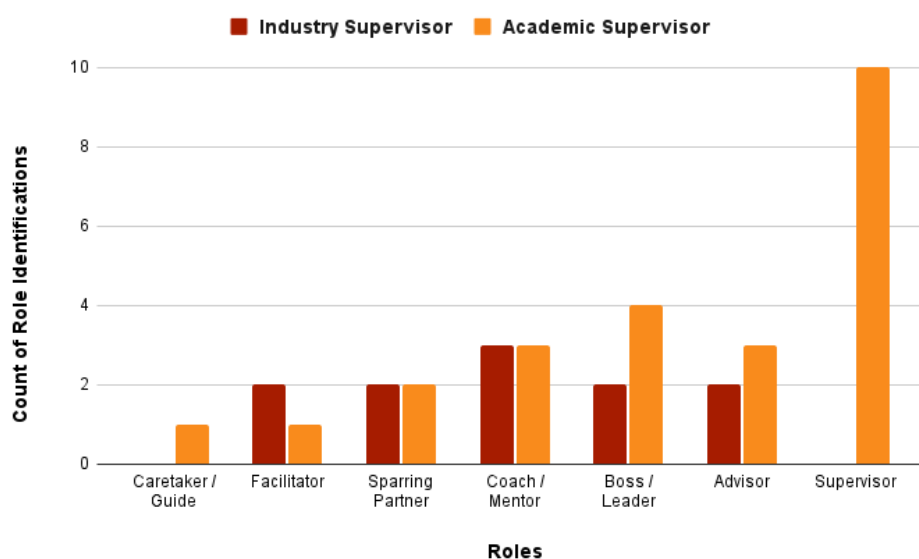


Figure 1. Perceived roles of industry and academic supervisors*

The roles the supervisors named reflected the nuanced and multifaceted nature of supervision. One aspect is the leadership and evaluation role of a boss or thesis supervisor. Another aspect frequently mentioned by both groups of supervisors is coaching or mentoring, particularly with regard to research goals, the acquisition of skills relevant to working in a company and career development. Some referred to their role as caretakers (German: "Kümmerer") and guides (German: "Wegweisende"), emphasising that they provide substantial help and support to guide the participants through the research or workplace processes and their career path. In a similar category is the advising role, which supervisors associate with giving advice on teaching or the technical side of work. Facilitator (German: "Ermöglicher") was mentioned as a role, in terms of giving participants the opportunity to undertake this dual employment within the tandem programme, pursuing their career goals in academia and at a company simultaneously. Another role mentioned by both industry and academic supervisors was that of sparring partner or collaborator. They described how, in this role, they feel a more reciprocal exchange of knowledge and ideas, emphasising the contribution of the participant.

Perceptions of the roles and of how many roles supervisors held at the same time also ranged from no role, through a single role, to a combination of two or more roles. A few supervisors reflected on multiple roles they are balancing in different aspects of the project. For instance, one industry supervisor mentioned simultaneously being a mentor, coach, boss or leader (German: "Führungskraft"):

* Note: The x-axis shows the roles mentioned by both industry and academic supervisors, while the y-axis illustrates the number of supervisors who identified with a given role. Some supervisors identified with more than one role.

These are different roles. There is a coaching role, a mentoring role, and also an indirect supervisory role. Therefore, I have different roles depending on the focus and task. In coaching, it is more about addressing interpersonal issues, lateral leadership in the project, and other matters to help advance the candidate. Mentoring, on the other hand, focuses more on the tasks and questions related to the doctoral thesis, breaking things down and moving them forward. And as a leadership figure, it involves the usual things like other tasks that need to be completed alongside the doctoral thesis, and that are part of everyday work. (O2P-3)

It should be noted that participants were employed in either doctoral or postdoctoral positions at TH Köln. Depending on their status, the academic supervisors viewed their role differently:

So, the role as a supervisor is, of course, different depending on whether I have someone in a post-doc position or working on a PhD. With a PhD student, I am much more of a caretaker and support them with guidance, but I don't necessarily feel on the same level. You first have to explain to them: How do I publish? What are the important framework conditions for that? What is a good strategy to successfully complete the PhD? I see myself as a helper and as someone who provides the guardrails on how best to navigate the process. (D2-3)

As such, supervisors for PhDs mentioned they had the traditional thesis supervisor role, which in some cases developed into collaboration in the case of students with a very high degree of independence. Meanwhile, postdoc supervisors voiced higher expectations towards postdocs, and said their role was to minimally advise and support in the necessary matters, such as the tandem programme or teaching:

And with a post-doc, it's of course quite different. There, we are totally on the same level. In my view, she is already fully qualified for a professorship. It's more than I act like a kind of mentor, giving her advice on what might be helpful on the path to a professorship. Right? And I also try to encourage her more to independently develop her own profile. (D2-3)

This section has outlined the diversity and complexity of supervisors' roles. The following section shifts focus to the perceived benefits and costs experienced by supervisors and participants within the tandem programme.

3.2 Benefits and costs

Perceptions of benefits and challenges varied considerably among supervisors. One industry supervisor, for example, said he did not see any particular benefits or downsides of the tandem programme, although he would have preferred to have all of the participant's time:

Yes, as I said, everything is going well. (laughs) But of course, I'm comparing it to a regular employee who works with us one hundred percent. And, as I said, I can't identify any disadvantages. So everything is going well, yes. Of course, I also can't identify any advantages; that's clear as well. Naturally, I wouldn't mind if he were employed by us as a regular full-time employee. But we just couldn't make that happen, yes. But I'd say it's a compromise that everyone can live with. (I2P-29)

By contrast, another industry supervisor identified a wide range of benefits across different areas, enough to "fill an A4 page":

An enrichment for the team. Not just for me personally, but the candidate works in product management or is anchored there. Of course, he also gains a lot of insight and enriches the team through small trainings, software implementation, or data platforms that were previously not accessible to us. So there is enrichment within the respective adjacent department but also beyond that: towards sales, data processing, etc. There are many areas. I believe I could easily fill an entire A4 page with points of intersection and added value. (O2P-27)

These two viewpoints illustrate the strongly contrasting perspectives present in the sample, with other answers falling into the spectrum between the two. Most supervisors, however, recognised the value and certain benefits of the programme.

Figure 2 presents a visualisation of the benefits for all stakeholders as reported by supervisors, and is based on the Social Exchange Theory, reflecting what each stakeholder brings to and gains from the collaboration. The benefits gained by the industry supervisor extend to the entire company, just as the academic supervisor's benefits contribute to the university as a whole.

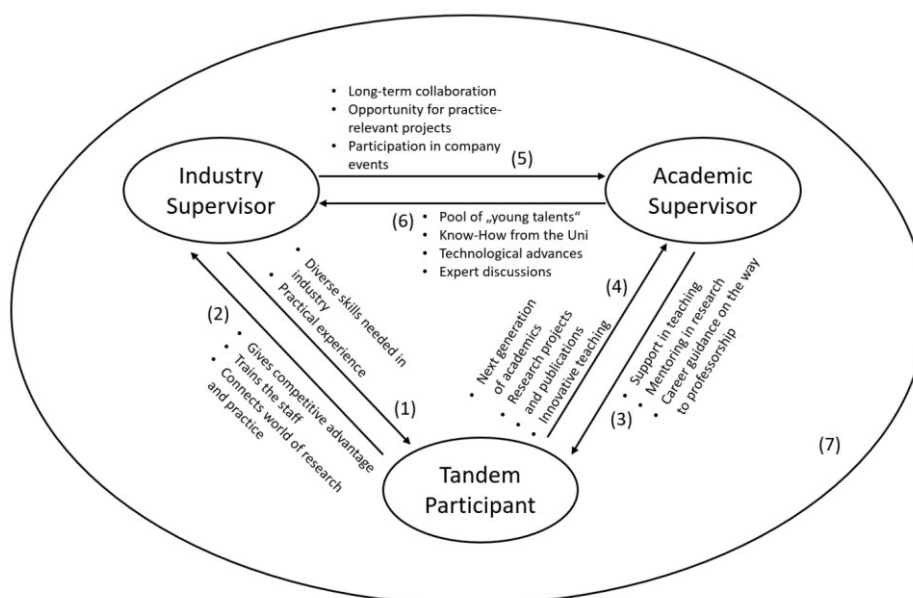


Figure 2. Benefits of tandem programme by supervisors

(1) The industry supervisor provides access to the industry work environment, projects, networks, and resources. This enables the tandem participant to apply research-oriented thinking to problems within the specific context. It was reported that participants learn a diverse set of skills needed in each line of work. Depending on their expertise, some participants supported improvements in teaching approaches.

(2) The tandem participant makes a meaningful contribution to the company. As mentioned by the industry supervisors, by connecting the “two worlds” of industry and academia, the tandem participant provides a competitive advantage to the company. This often happens through activities such as teaching staff members data analysis or the use of software tools, as well as through applied research.

(3) Academic supervisor supports the participant in various ways, including mentoring on good scientific practice and assisting with publication writing. Some supervisors also provide advice on teaching methods and pedagogical approaches, contributing to the participant's professional development beyond research skills. In addition, many of the academic supervisors provided career guidance, especially for postdocs on the way to professorship.

(4) The benefits that tandem participants offer academic supervisors vary depending on the individual case. For some, having a tandem participant “saved that research direction” in their institute; for others, the participant “brought innovative pedagogical approaches.” Many mentioned the benefit of participants acting as a connecting link between industry and research. Overall, tandem participants contribute to the next generation of academics through practice-based research projects, publications, and teachings.

(5) Industry supervisor serves as a long-term collaboration partner for the academic supervisor, which is particularly important, especially at universities of applied sciences. This partnership establishes sustainable cooperation that strengthens both academic programmes and industry innovation. In certain cases, such benefits as being invited and participating in company events and workshops were seen as valuable benefits.

(6) Thanks to the academic supervisor or tandem employee themselves, the company (supervisor) gains access to a “pool of young talents,” a benefit consistently mentioned by all industry supervisors. This pool includes not only tandem participants but also interns, master’s and bachelor’s students with thesis projects. Furthermore, industry supervisors have reported engaging in discussions with professors beyond the tandem programme: discussions about potential future research directions and valuable exchanges of perspectives due to their overlapping fields of expertise. Some also benefit from technological advances and tools developed at the university, which further support their practice.

(7) If we consider interactions among all three stakeholders: industry supervisor, academic supervisor, and tandem participant, synergies emerge that surpass dyadic relationships. This triadic collaboration creates a system where academic knowledge, practical expertise, and individual career development converge. The results may include enriched learning environments, co-created knowledge, and a robust partnership benefiting the university, industry, and participants alike. Both academic and industry supervisors mentioned the synergy effects:

So these synergies from both worlds - I wasn't really aware before of how much impact they could have. I think this could be highlighted well for future projects. Or maybe prepare some best practices and show what this has actually brought overall. If I were to spend two or three hours on it, I think a pretty extensive mind map would come out of it, outlining what we have implemented in these two years, actually two and a half years. That's quite a lot. (O2P-105)

After outlining the benefits, we now turn to the costs associated with the tandem collaboration.

Industry supervisors identified several challenges, including uncertainty about the tandem participant’s future career path (whether they would remain in academia or fully transition to industry), which complicated planning and commitment. Practical issues, such as long commutes between cities, added logistical burdens. The “special conditions” applied to tandem participants sometimes caused envy among colleagues. Additionally, unforeseen needs, such as IT support that delayed project initiation, highlighted the importance of planning adequate infrastructure from the start. Another common concern was that supervisors did not have exclusive access to the participant’s time, requiring them to “share” and negotiate competing demands.

Academic supervisors described a different set of challenges related to the unique dual role of tandem participants. Many noted that participants often prioritised company tasks over research, making it difficult to maintain academic progress. The dual focus placed extra demands on participants, who faced more complexity than regular PhD students or postdocs. Conflicts were seen as unavoidable when balancing company deadlines, publication pressures, and multiple responsibilities. Some academic supervisors felt they lost a degree of control over the research project because of the company’s involvement. There was also concern about participants overworking to meet expectations in both settings. For postdocs, especially, limited university time, sometimes described as a homeopathic dose, hindered their ability to make substantial progress or reach key milestones.

The main cost mentioned by both industrial and university supervisors was having to “share” the participants’ time. Several industry and academic supervisors shared the perspective that they seemingly “lose” the time of the participant while the other stakeholder gets it, and they have to compromise. However, another common perspective was that it is a win-win situation, from which synergies between academia and industry arise. In some cases, uncertainty about the future career choice of the participant was also a common cost. In other constellations, however, there already existed an agreement on future employment plans.

As seen from this section, the perceived benefits and costs varied greatly, forming a wide spectrum of options. In a similar manner, the collaboration efforts were also different in each constellation, which is discussed in detail in the following section.

3.3 Collaboration

Tandem participation provided a core structure: a doctoral researcher or a postdoc is simultaneously employed and supervised at TH Köln and at the partner organisation. Additionally,

the agreements outlined the roles, expectations, and suggested structure. Nevertheless, how each trio collaborated in practice varied. Through the interviews with both industry and academic supervisors, we observed that the following aspects were of importance when it comes to collaboration: structure, mode of work, flexibility, emotional climate, and stakeholder interaction. Table 1 summarises the findings, underlining these main aspects, the corresponding practices within each aspect, and sample quotes from the supervisors.

Table 1. Collaboration practices in the tandem programme

<i>Aspect</i>	<i>Practices</i>	<i>Quote</i>
Structure (or lack thereof)	- Well-organised interactions - Set goals and milestones - Regular meetings and status updates vs. no regular meetings - Emails with next steps, meeting details	It's about communication, without any competition or power struggles over who works where and when. Instead, we've agreed on a solid approach. The focus is on communication, collaboration, and ongoing development within the project itself. This happens through breaking down the work into milestones and goals, asking, "Okay, what would we like to achieve by this date?" (O2P-37)
Mode of Work	- In-person meetings - Hybrid format with on-site meetings every 2-4 weeks - Weekly meetings	He actually works most of the time from home in [Place]... He simply records the hours he's worked... Every two weeks, he comes here for two days. Then we have general meetings. Although it's not always exactly every two weeks, sometimes it's every three or four weeks. It really depends on current needs. (I2P-27)
Flexibility (or lack thereof)	- Company – allows time for teaching and publishing vs. requires more time - University – allows time for urgent company matters vs. expects more input	From what I understand, as a company, we have the opportunity to really emphasise personal responsibility and use flexibility in how we shape things. For example, if a new research area emerges at the TH, and we think, "Okay, just go for it — this is interesting," we're open to allowing or enabling that, even if it doesn't directly fit within our usual business scope. It's a kind of risk management approach. I believe the TH must be a bit more structured and stricter because of its organisational setup and its responsibilities, like ensuring teaching requirements are met. So, it probably can't be as flexible as we are. (F2P-59)
Emotional Climate (if mentioned)	- Appreciative - Commitment - Soft skills - Joy in working and collaborating	It's going really well. Nothing to complain about because there's mutual understanding and genuine interest. She also actively said yes and didn't have to do it. I don't know how it works with other tandems or trios, but I believe that commitment is really important for things to continue working well afterward, right? (O2P-99)
Stakeholders Interactions	- Industry supervisor with tandem participant - Industry supervisor with academic supervisor	Exactly, we have regular meetings. Yes, exactly. Both I and the candidate and the three of us together. And the professor also has regular meetings with the candidate because he is really on site fifty-fifty. (O2P-39)

Table 1. Collaboration practices in the tandem programme (continued)

Aspect	Practices	Quote
Stakeholders Interactions	- Academic supervisor with tandem participant - All 3 stakeholders together	So, as a major project, he has a [project], and other [topic areas], where the colleague from the university serves as a sparring partner. So, I can also bring up questions or topics where I think I need a bit of input or a fresh pair of eyes to take a look and give feedback from her experience and expertise. (O2P-67)

The analysis showed a range of experiences regarding the structure and organisation of the interactions. Some trios created a clear structure, including goals, milestones, and regular update meetings supported by follow-up emails. However, some other groups lacked the structure. Most groups had recurring meetings, but not necessarily a common vision. It is evident from the stakeholder interaction aspect that some of the trios were only linked by the tandem participant. As such, an industry supervisor would have meetings with the participant to discuss the matters of the company, and an academic supervisor would meet with the participant on research matters. However, the closer collaboration and mutual benefit for research and practice seemed to be lower in such trios. In other instances, all three stakeholders met together to keep up with research updates that were relevant for the company and to find other common ground, such as sharing knowledge on the best tools or advanced technology in the field. Furthermore, some supervisors met separately without involving the participant. In this case, an industry supervisor reported that the meetings with the professor were fruitful beyond themes that concerned the participant, but rather as an exchange of experts.

Modes of work varied widely as well. Some teams met regularly in person, while others followed a hybrid approach, with on-site meetings every few weeks combined with remote interactions. Weekly meetings were common in some cases, but others had less frequent or irregular contact. Especially in cases of postdocs, the reported frequency of meetings with academic supervisor was considerably low. Alongside these differences in working modes, the emotional climate during collaboration also varied. While some participants did not mention the emotional aspect explicitly, others emphasised its importance, noting that soft skills, mutual appreciation, commitment, and enjoying the work together were key to positive and productive relationships.

Flexibility was essential for balancing responsibilities between industry and academia, and supervisors approached it in different ways. Many expressed a perspective that they had to share the participant's time, while preferring full availability. Some supervisors were more understanding, intentionally allowing space for the participant's commitments in the other setting. Some adopted a "live and let live" attitude, with the company and academic sides operating independently. Meanwhile, other supervisors viewed themselves as facilitators who actively supported participants in both environments and ensured collaboration between the two.

Collaboration was shaped by varying degrees of structure, flexible working arrangements, differing emotional climates, and diverse stakeholder interaction patterns. These factors collectively influenced how smoothly and effectively the participants worked together.

4 Discussion

4.1 Perceived roles

In our analysis, we observed that the roles largely correspond to the ones described in prior research. Roles such as supervisor, advisor, mentor, and guide were among the main functions of a supervisor outlined by a large international study (Guarimata-Salinas et al., 2024). Another specific example, facilitator (German: Ermöglicher), corresponds to the role of guide in self-realisation processes (Reis & Szczyrba, 2011), or "pastoral" supervisor (Deuchar, 2008). In our sample, such a "facilitator" reported to have the best interests of the participant at heart, providing him with the opportunity to fulfil his professional goals in both the academy and industry. The perceived roles

differed as to the degree of involvement of the supervisor. While some supervisors reported that they see themselves as caretakers, others as guides and advisors supporting with expert recommendations, yet others portrayed the earlier described laissez-faire style (Deuchar, 2008), defined by letting the participant work independently. What stood out in our analysis was the role of collaborator or sparring partner. The prior literature focuses rather on the hierarchical relationship between supervisor and the individual, whereas several supervisors in the sample spoke about an equal partner exchange, be it with a postdoc or a doctoral student.

In reviewing the literature and interview data, the roles of supervisors can generally be categorised into three key aspects: (1) introducing participants to foundational knowledge, essential procedures, and practical skills required for their research or work (encompassing the roles of supervisor and advisor); (2) providing ongoing support and guidance to facilitate individual career development (including the roles of mentor, coach, and facilitator); and (3) ensuring the quality and integrity of work outcomes (reflecting the roles of supervisor, boss, and leader).

As discussed in the theoretical framework, the Sapir-Whorf hypothesis suggests that the way individuals perceive and conceptualise roles influences their behaviour and actions. Applied to supervisors, this means that their understanding of their role shapes how they act in practice. Our data support this: supervisors describe their roles in markedly different ways, which correspond to variations in their attitudes and behaviours. For example, one supervisor stated that they see no role for themselves in relation to the tandem programme and therefore do not engage with the participant on this matter. In contrast, another supervisor identified multiple roles (such as boss, coach, and sparring partner) and established a structured approach involving regular meetings, status updates, and thorough discussions. Others viewed themselves primarily as advisors focusing on technical and pedagogical support, and accordingly, their communication and interactions revolve around these aspects. This variability illustrates how role perception directly informs supervisory behaviour and interaction patterns.

The findings of this study reveal that, although the role of a supervisor encompasses a diverse range of functions (such as to guide the skill development, to mentor regarding career path, to supervise the quality of work), supervisors themselves rarely perceive their role as encompassing this full spectrum. Rather, most participants described their supervisory role in more limited terms, identifying primarily with one or two functions, such as acting solely as an advisor or a guide, or providing minimal support while promoting independent work. Only a few supervisors reported integrating multiple roles. This observation points to a broader systemic issue: the absence of a clearly defined, shared understanding or standardised benchmarks for supervision. Without such common frameworks, the nature and quality of supervision largely depend on individual supervisors' experience, engagement, and commitment to fostering early-career researchers. This variability affects doctoral students, post-doctoral scholars, and workplace supervisees alike. Addressing this challenge calls for the establishment of formal quality standards and a consensual conception of supervisory roles that can be adapted to different career stages. Given the distinct needs of doctoral and post-doctoral researchers, differentiated expectations and guidelines are warranted. This has already led to a large number of guidelines and charters for both postdoctoral and doctoral supervisors. Supervision agreements were dutifully signed by all supervisors in the tandem programme and are also essential as a first step towards quality assurance. However, like guidelines, they do not encourage reflection on one's own role and leave room for individual interpretation (Confirmation bias). Their utility is also limited if supervisors lack the time or motivation to engage with them fully. Therefore, workshops and supervisor networking meetings are recommended as particularly effective and feasible strategies to promote continuous development and shared understanding of supervisory roles.

Current approaches to enhancing supervisory practice, such as workshops (Reis & Szczyrba, 2011), signing agreements, and having regular support meetings as used in the tandem programme, offer promising avenues for ongoing professional development. These formats facilitate reflection, peer learning, and practical skill-building in a manner that is more accessible and goes deeper than comprehensive handbooks or guidelines. While our study does not prescribe the exact content of such interventions, future research should focus on tailoring these initiatives based on empirical findings and existing literature.

In sum, enhancing supervision requires the articulation of clear role definitions and quality benchmarks, alongside the provision of accessible, ongoing support and training opportunities for supervisors.

4.2 Benefits and costs

Our findings suggest a possible pattern between perceived benefits and the perceived value of the tandem programme among supervisors. For instance, supervisors who reported minimal or no value from the programme often described their role as limited and viewed the arrangement more as an uncomfortable compromise than a mutually beneficial collaboration. One such supervisor expressed a preference for having 100% of the participant's time, seeing the tandem setup as a constraint rather than an asset. On the other hand, an industry supervisor highlighted substantial value in the programme: not only in supporting the participant but also in fostering expert exchanges with the academic partner. This supervisor valued gaining access to university know-how, technical advances, and tools, as well as opportunities for the tandem participant to train company staff. Academic supervisors' views also varied: some felt the company's involvement dominated, leaving little room for research. While others emphasised the long-term partnerships developed through the programme, which even allowed their research direction to keep existing. A third group gave mildly positive evaluations, recognising some benefits but remaining relatively uninvolved with the other supervisor, limiting interaction to the participant serving as the sole link between academia and industry. These perspectives point to a pattern where supervisors' perceived value and benefits from the tandem programme appear connected to the extent of their engagement and the quality of tandem interactions.

According to Social Exchange Theory, the relationships endure when perceived benefits outweigh such costs, resulting in a positive profit for all stakeholders involved. Recognising and addressing these challenges is essential to minimising costs and maximising benefits.

The described costs could be minimised in the following way. First, the potential benefits of the programme, visualised in Figure 2, may be brought to the attention of all the stakeholders in a structured way. According to SET, the quality of interaction and collaboration improves when the perceived value of exchange is high. In other words, all participants need to be on the same page about the mutual benefits and synergies they may get out of the collaboration. Second, some supervisors mentioned it would be easier with having clearer roles and expectations:

I would prefer if the roles were more clearly defined. If this dual function didn't exist. That is actually the main problem. I would actually prefer if it were clear that we are doing something together. (A2-107)

Within the tandem project, the supervision agreements were signed later on in the project as a response measure, in order to bring more clarity to the roles and expectations. Another way of minimising that cost was organizing meetings between supervisors and supervisor workshops. Third, although essential settings and equipment were in place for the tandem participants, one of the suggestions on minimising costs was to meticulously plan the infrastructure needed for the participant in advance (i.e., what technology, software, tools, and resources are needed for the success of the project):

At the beginning, we realised we needed to set up an internal database or have the right connection and computing power. This was a challenge because IT wasn't really on our radar from the start. That's why we couldn't get going as quickly as we would have liked. However, this was resolved fairly quickly. I think for future tandem projects, it's important to keep this in mind: to consider what kind of infrastructure the candidate will need and what the project goals are. (O2P)

Given that such practice-research partnerships maximise the benefits and minimise costs, they may, as some of the tandem programme stakeholders, experience the synergies between the industry and academia.

4.3 Collaboration

Collaboration in the trios varied considerably in our sample. Supervisors differed in how flexibly they engaged with participants, how regularly they met, and how structured their joint processes were. When we consider these patterns together, several elements emerge that appear to support more effective collaboration. First, supervisors emphasised the importance of clearly articulated expectations and a transparent structure, including defined goals, milestones, and meeting routines. Second, collaborative relationships benefitted from a degree of mutual flexibility and a shared understanding of the demands on both sides (i.e. “sharing” the participant’s time), which enabled compromise. Third, a positive interpersonal climate, characterised by appreciation, soft skills, and genuine commitment, seemed to be of importance for better collaboration.

Interpreted through the lens of Social Exchange Theory, these elements reflect conditions that foster a “productive exchange” (Emerson, 1975, p.357). Productive exchange occurs when multiple actors work together to create a combined outcome that is more valuable than the sum of their individual contributions. Although not used by SET theoreticians, this concept is very close to the notion of synergy, also mentioned by tandem supervisors. Productive exchange seemed to take place when supervisors perceived tangible value in the tandem arrangement. Both industry and academic supervisors saw significant value in the collaboration. Industry supervisors appreciated benefits such as gaining a competitive advantage by supporting each other, having participants teach company staff, and utilising university tools. Meanwhile, academic supervisors valued the long-term partnerships with companies, opportunities to participate in company events and workshops, and being part of a meaningful synergy between practice and research. We noticed that supervisors who mentioned many benefits of the tandem employment, that is, had a high perceived value of it, also reported having a high-quality collaboration characterised by clear structure, flexibility, and a positive emotional climate.

4.4 Limitations

This study has several limitations to consider when interpreting the findings. First, the sample was somewhat unbalanced, including only 6 participants from partner organisations compared to 14 supervisors from TH Köln. This uneven distribution may have influenced the range and depth of perspectives represented, particularly from the side of the partner organisation, potentially limiting the generalisability across the groups. Second, the analysis did not explore differences related to gender or participants’ areas of expertise. As a result, any variations in perceptions along these lines remain unexamined. Third, the relatively small sample size, typical of qualitative interview studies, limits the extent to which the findings can be generalised beyond the specific context of this study. Finally, the study exclusively focused on supervisors’ perspectives and did not include other stakeholders such as trainees or organisational leaders, which may offer additional insights into the collaboration process. Future research could address these limitations by including a larger and more balanced sample, integrating demographic and professional variables into the analysis, and broadening the stakeholder groups interviewed.

5 Conclusion

This study aimed to investigate the perceived roles of academic and industrial supervisors, analyse the perceived benefits and costs of the tandem programme, and explore the collaboration among the stakeholders. Applying Social Exchange Theory (SET) provided valuable insight into how perceived value influences the quality of such collaborative endeavors.

Our findings show that, in optimal conditions, all stakeholders benefit significantly, creating a synergistic “win-win-win” scenario. Participants gain the unique opportunity to pursue both academic and industrial workplace pathways, enriching their learning experience through guidance from both supervisors. Industry supervisors acquire cutting-edge knowledge, tools, and a fresh research perspective that contributes directly to company innovation. Meanwhile, academic supervisors and universities deepen their impact by engaging in meaningful, long-term partnerships that ground research in practical relevance.

Looking towards the 2030 goals, the insights gained here support the development of more effective frameworks for bridging academia and industry. By fostering these tandem collaborations, we not only advance individual and organisational growth but also contribute to sustainable practice-research ecosystems. Encouraging such cross-sector partnerships aligns with global sustainable goals.

In summary, by capturing supervisors' insights, this research brings attention to the critical question of supervision quality and its continuous improvement. It also lays the groundwork for understanding potential benefits and best practices in collaboration, which can guide the development of more effective and impactful tandem programs in the future.

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Appendix A - Interview guide for supervisor interview, tandem programme

1. Roles

- How would you describe your role in relation to the tandem participant and why?
- What role does the industrial supervisor/ academic supervisor* play in the supervision and support of the tandem employee?

2. Benefits and costs

- What added value does the tandem employment model have in your view for you personally? What do you think has gone well in your tandem constellation so far? Follow-up: What do you think has led to these positive experiences or results?
- What challenges do you see in your tandem constellation so far? Please also consider tandem employment in general, the collaboration with the industrial supervisor, the integration of the tandem employee into research and teaching, and the integration of the areas of research, teaching, and practice.
- How do you deal with these challenges?

3. Collaboration

- How do you perceive the cooperation or collaboration between you, the industrial supervisor/ academic supervisor, and the tandem employee?
Follow-up: Can you tell us how and how often communication or exchange between you and the industrial supervisor/ academic supervisor is organized?
Follow-up: What content-related overlaps do you have with the supervision of the industrial supervisor / academic supervisor?

* For the sake of space, we combined two interview guides: one for industrial supervisors and one for academic supervisors, into a single document. Whenever a question refers to the role or collaboration with the "other" supervisor, this is reflected as follows: if the question is posed to industrial supervisors, the question mentions academic supervisors, and vice versa.

Follow-up: Do you perceive different interests between you and the industrial supervisor/ academic supervisor? If yes, how do you handle these different interests Follow-up: Where do you see similarities and differences regarding the understanding of science between you and the industrial supervisor/ academic supervisor? What effects does this have on your collaboration?

- How do you deal with any discrepancies?
Follow-up: Which other aspects do you find helpful in working with the industrial supervisor/ academic supervisor? Which do you find rather disturbing?
- How would you describe an ideal state of collaboration with the industrial supervisor/ academic supervisor? Please also consider the supervision of the tandem employees.