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Maximilian Heimstädt & Sascha Friesike

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The odd couple: contrasting openness in innovation and science

Maximilian Heimstädt and Sascha Friesike

Weizenbaum Institute, Berlin, Germany

ABSTRACT

Over the last few decades, two domains have undergone seemingly similar transformations: Closed innovation turned into open innovation, closed science into open science. In this essay we engage critically with recent calls for a close coupling of the two domains based on their apparent commonality: openness. Comparing the historically-specific ways in which openness has been defined and mobilised, we find substantial differences between open innovation and open science. While openness in innovation was developed as an analytic concept and redefined quite flexibly over time, openness in science was created as a programmatic concept and its initial definition has been preserved rather rigidly. Contrasting openness in innovation and science helps anticipate some of the unintended consequences that a close coupling of these domains might yield. A close coupling might alienate advocates for change within the academic community, marginalise maintenance-oriented collaborations between science and practice, and increase the dependence of science on profit-oriented platforms. Reflecting upon these unintended consequences can help policy-makers and researchers to fine-tune their concepts for new forms of engagement across the science-practice divide.

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Openness: connecting piece or false friend?

Openness has become a 'master category' (Tkacz, 2012, p. 387) for describing new forms of organising. Within this 'open revolution' (Pollock, 2018), two domains of organising frequently described as becoming more open are innovation and science. Recently, policy-makers, research funders, and think tanks began to call for a closer coupling of these two domains (Blümel et al., 2019; European Commission, 2016; Fingerle, 2019). For example, the European Commission presented open innovation and open science as two main pillars of their research agenda (European Commission, 2016). In a similar vein but more explicitly, the German think tank Stifterverband proposed that by linking open innovation and open science through a political framework of 'strategic openness', firms would be able to increase their innovation outputs and the public's trust in science could be bolstered (Blümel et al., 2019; Fingerle, 2019). Rather than supporting open innovation and open science as distinct phenomena, these actors propose that research institutions, firms, and society at large would benefit from a closer coupling. While these policy

CONTACT Maximilian Heimstädt m.heimstaedt@udk-berlin.de

proposals remain rather vague on what such a close coupling means in practical terms, they all share the view that openness has emerged as a promising 'connecting piece' between innovation and science.

This view on openness as a connecting piece is not limited to policy-making; it has gained popularity in academic inquiry as well. In general, most of this research examines the conditions for, and the outcomes of a close coupling between open innovation and open science. Within this literature, one line of work empirically examines cases in which the domains of open innovation and open science converge and become coupled (Perkmann & Schildt, 2015; Perkmann & West, 2014; Susha et al., 2019; Vicente-Saez et al., 2020). For example, Perkmann and Schildt (2015) studied how the Structural Genomics Consortium served as a boundary organisation, allowing for unprecedented open data partnerships between private firms and academic scientists. Another line of work develops conceptual frameworks to demonstrate the possibility and potential benefits of coupling open innovation and open science (Beck et al., 2020; Friesike et al., 2015; Smart et al., 2019). For example, Beck et al. (2020) have recently introduced the 'open innovation in science research framework' (p. 6) in order to 'highlight potential synergies' (p. 3) and eventually bring together the 'complementary concepts' (p. 6) of open innovation and open science. In a similar vein, Smart et al. (2019, p. 279) argue that open innovation and open science already exist in a relationship of 'co-evolution, co-existence, and co-production', which allows for a 'generative coupling' of the two. Linked through openness, the authors suggest, innovation and science together can stop the drifting apart of experts and non-expert audiences in 'an age of post-truth populism' (p. 279).

In this essay, we challenge this predominant view of openness as a connecting piece between innovation and science. While the idea allows researchers and policy-makers to assess the potentials of coupling open innovation and open science, there is hardly any assessment of the problems such a close coupling could create. As an alternative vantage point, we present the view of openness as a 'false friend'. Although transformations in both domains are described using the label of openness, we argue that the historically-specific ways in which openness has been defined and mobilised in innovation and science differ drastically. Open innovation started as an *analytic concept* used by innovation researchers to describe various changes in the way the R&D departments of technology firms handle intellectual property rights and ideas. Continuously redefining the concept of openness in flexible ways helped this research community to grow and to demonstrate its relevance to firms, other researchers, and research funders. By contrast, open science was developed as a *programmatic concept* by activist academics, one that allowed them to gather peers around the shared goal of transforming established scientific practices. Only carefully updating their definition, and strongly policing how terminology is used by others helped this academic movement to maintain momentum and to prevent co-optation.

Understanding the historically-specific differences in how openness has been conceptualised and mobilised in innovation and science helps us to anticipate some of the negative unintended consequences that a close coupling of the two domains might yield. While proponents of a close coupling present it as mutually beneficial, we find that for the domain of science, negative consequences are predominant. In total, we find three types of negative unintended consequences: *First*, a close coupling with open innovation might drive out some of the core members of the open science movement. Losing these core members would

diminish the community's potential to transform scientific practices in order to better address societal challenges like post-truth populism. *Second*, a close coupling with open innovation might suppress generative couplings between science and practice that are not directed at innovation, such as practices of maintenance and care. *Third*, a close coupling with open innovation might increase science's dependence on profit-oriented platforms. Our assessment of these unintended consequences suggests implications for policy-making and future research. Policy-makers should allocate resources to open science projects aimed at innovation as well as to those not aimed at innovation. They should also reassess whether certain forms of scientific research are already too closely coupled to industry. Future research should examine the full array of collaborations between science and non-science stakeholders. Furthermore, by studying different forms of openness in action rather than integrating them conceptually, the open innovation community may be able to follow new trajectories towards relevant and surprising research findings.

Openness in innovation: analytic and flexible

The concept of open innovation was coined by business school professor and innovation scholar Henry Chesbrough in 2003. Chesbrough (2003) argued that new technologies and a changing labour market were pushing technology firms from a model of closed innovation towards a 'paradigm' of open innovation, in which 'valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well' (2003, p. 43). He supported his new concept with case studies on large firms such as IBM, Intel, and Lucent, each providing insights into different and very specific innovation practices. Chesbrough introduced open innovation as a concept that allowed him to capture and collectively refer to these emerging innovation practices of technology firms. Chesbrough did not provide a clear-cut definition of what exactly rendered an innovation activity either open or closed. He described openness as a more general trend, which appears in all kinds of firms but which can be traced back to the same root causes.

As an analytical concept, openness helped its creators (mainly Henry Chesbrough and his students/collaborators) to build a new academic community within the larger field of business research – a process which Mehrpouya and Willmott describe as 'knowledge branding' (2018, p. 729). Through publications, workshops, conferences, and a considerable number of special issues, this group of 'academic entrepreneurs' (2018, p. 729) has managed over the last two decades to attract an ever-expanding group of scholars willing to frame their research using the concept of open innovation. While some of these research projects have engaged with very similar empirical situations to those initially described by Chesbrough (2003), others have engaged with considerably different types of organisations, actors, and products. For example, scholars began to describe the platform-mediated crowdsourcing of ideas as a form of open innovation (Ebner et al., 2009), to analyse open innovation intermediary organisations that link firms with crowds (Kokshagina et al., 2017; Randhawa et al., 2017), or use open innovation as a reference when describing how government agencies allow citizens to provide feedback on the design of public services (Heimstädt & Reischauer, 2019; Mergel & Desouza, 2013). As described above, most recently scholars have argued that the production of scientific knowledge can be understood through the concept of open innovation as well (Beck et al., 2020).

Rather than dismissing these projects as unrelated to the initial scope of the open innovation concept, the open innovation research community included these projects by flexibly 're-conceptualizing' (Dahlander & Gann, 2010, p. 699) its definition of openness (see Rangus et al., 2016; West & Bogers, 2014, 2017). For example, established open innovation scholars argued that adjacent organisational domains such as strategy could be analysed through the lens of open innovation as well (Chesbrough & Appleyard, 2007). Serving as an 'obligatory point of passage' (Mehrpouya & Willmott, 2018, p. 729) for new research on open innovation, the academic entrepreneurs were able to expand the definition of openness continuously. Such an expansion of the definition created a win-win situation for established and emerging scholars, as it meant more opportunities to publish, hence raising numbers of citations for everyone involved.

As the research community on open innovation grew, it was not only able to expand its territory vis-à-vis other research communities (Mehrpouya & Willmott, 2018), but also to establish itself as a relevant actor for firms and other audiences of business research. Global conferences on open innovation were not limited to academic discussions, but attracted high-status representatives from industry as well. Through managerial training, consulting services, and a constant stream of open innovation researchers who traded their academic careers for jobs in industry, the concept of open innovation was transferred from innovation research back into firms, some of which had served as empirical grounds for the concept in the first place. While we know little about the ways in which people in organisations mobilise the concept of open innovation (a few tentative ideas can be found in Lichtenthaler, 2011, pp. 79–80), we can assume that when a concept like open innovation begins to travel through organisations, its definition becomes even broader and more flexible over time. As we will now show for the case of open science, the use and definition of openness can differ drastically when the concept originates as a device to organise a community of activists rather than as a theoretical lens.

Openness in science: programmatic and rigid

The concept of open science was initially developed by a small international and interdisciplinary group of activist academics who – inspired largely by new digitally-mediated forms of communication and collaboration – wanted to change the way scientists make their results available to other scientists and to the public (Molloy, 2011). As a foundation for their occupational change movement (Howard-Grenville et al., 2017), these activist academics developed a very precise definition of what openness means in the context of scientific knowledge. In contrast to closed science, in 2006 they defined open science as having outcomes which are 'accessible, reproducible, and re-usable without legal, social or technological restriction' (Open Knowledge Foundation, 2006). In the following years, members of this nascent open science movement mobilised the definition to imagine and experiment with more 'open' versions of scientific practices, such as open access journals, open data repositories or open educational resources (Bartling & Friesike, 2014). Other than in open innovation, openness in open science was not developed initially as an analytic category used to describe and explain existing practices, but as a programmatic framework within which to imagine and mobilise support for change towards new practices. Through the programmatic concept of openness, activist academics initially referred, not to what *is* but to what *should be*.

While scientific practices such as open access publishing or open data sharing are widely accepted in many disciplines today, the open science activists in the 2000s were either simply ignored (e.g., by most policy-makers and research funders) or criticised for their convention-breaking vision of science. While some critics simply feared that greater openness in science might erode established quality standards (e.g., pre-prints are not peer-reviewed), others framed the open science advocates as an 'anti-corporatist' movement seeking to 'collectiviz[e] production' and 'deny the freedom of the press' to traditional academic publishers (Beall, 2013, p. 596). This challenging context explains why the activist academics took great care to ensure the precision of their definition as a focal element of their movement and a tool to identify antagonists. Since its initial formulation in 2006, there have been a handful of updates on the wording of the initial definition of openness; however, each of these updates has been rather marginal and aimed at creating less rather than more ambiguity (Open Knowledge Foundation, 2015). These updates have not been phrased by individual members of the movement, either, but resulted from long deliberations within the community (Lainchbury & Pollock, 2015).

The open science advocates not only maintained their definition internally, but also actively policed acts of 'openwashing' (Heimstädt, 2017) – situations in which actors in or outside of science used the 'open' label in ways that conflicted with the movement's definition. One of these policing practices was to publicly shame individuals or organisations on social media using the hashtag #openwashingnominee. Policing of openness, however, also took place towards a broader and more general audience. At the onset of the open science movement, most large academic publishers rejected the idea of transition to open access models of publishing. However, driven by transnational science policy initiatives such as Plan S in Europe (Else, 2018), academic publishers gradually began to adjust some of their publication practices and presented themselves publicly as supporters of open science. Among many open science advocates, these strategic manoeuvres were considered a form of openwashing. For example, in an op-ed in the newspaper *The Guardian*, the open science activist Jon Tennant criticised the European Commission's decision to hire the academic publishing company Elsevier as a consultant on new open science policies. After listing episodes and activities in which Elsevier has apparently breached the values of the open science community, he concluded that 'it seems like a profoundly undemocratic practice to have a company with such an anti-open history now with such a powerful position in the future of open science in Europe'. Even more drastically, he added: 'That's like having McDonald's monitor the eating habits of a nation and then using that to guide policy decisions' (Tennant, 2018).

Above, we have shown how the concept of open innovation was developed by innovation researchers and later transferred into organisations through management education and consulting. The career of open science as a concept developed the other way around. Open science was developed by academics, yet not as a primary outcome of their research but as a device for transforming their own profession. Only after new practices emerged from these mobilisation efforts was the programmatic concept picked up and translated into an analytical concept by science scholars (Beck et al., 2020; Smart et al., 2019; Vicente-Saez & Martinez-Fuentes, 2018) and policy makers (Blümel et al., 2019; European Commission, 2016; Fingerle, 2019). Instead of adopting the definition of open science as developed by the activist academics, many science scholars and policy

makers developed their own definitions of open science (for a review of definitions, see Vicente-Saez & Martinez-Fuentes, 2018), which did not necessarily comply with the open science movement's definition.

Unintended consequences of a close coupling

Historically, the ways in which openness has been defined and mobilised differed between innovation and science. As concepts began to travel and communities around these concepts continued to grow, these differences might have become blurry to those policy-makers and researchers who recently proposed a closer coupling between the two domains (Beck et al., 2020; Blümel et al., 2019; Smart et al., 2019). However, it is not *despite* but exactly *because* of these demarcation difficulties that we should be aware of the unintended consequences that may arise from a close coupling of open innovation and open science. In other words, these consequences would not be unintended if the difference between the two domains of openness had been more generally apparent. We derived unintended consequences from our historical comparison in two ways. First, the comparison helped us to identify situations in which actors have already attempted to couple open innovation and open science, as in the case of 'open data partnerships', for example, (Perkmann & Schildt, 2015). These situations provide insights, as they showcase specific arenas in which a close coupling does not seem to create unintended consequences. However, they also reveal which aspects of open science are *not* discussed in these contexts. Second, we explored questions such as 'Would this specific form of open science/innovation still be possible after a close coupling?', 'If yes, how?', and 'If not, why not?'. This allowed us to discuss scenarios of 'possible worlds', as theorists of counterfactual reasoning would say (Durand & Vaara, 2009, p. 1250).

In the following, we discuss three types of unintended consequences, which emerged as salient through our historical comparison of open innovation and open science. Although we searched for potential unintended consequences for both domains, all three relate primarily to the domain of science. Being more reflexive about these unintended consequences can enable policy-makers and researchers to re-evaluate their plans and expectations regarding a close coupling of the two domains.

Alienating change advocates

A close coupling with open innovation might alienate focal members of the open science community, thereby hampering the movement's potential to reorient science towards new societal challenges like post-truth populism (as proposed by Smart et al., 2019). Today, the open science movement is a heterogeneous community with some dogmatic and some more pragmatic 'schools of thought' (Fecher & Friesike, 2014). When policies encourage a close coupling of open science and open innovation, there is a substantial danger of alienating the activist academics who identify strongly with the movement's initial definition of openness. This threat will become particularly salient when a coupling with pecuniary practices of open innovation, such as 'selling' or 'acquiring' (Dahlander & Gann, 2010), is promoted, as these practices are clearly at odds with the orthodox definition of openness in science described above. For example, a firm might licence some of its datasets to academic researchers. From the firm's perspective, this

activity might be considered a form of open innovation. Pragmatic scientists might consider this influx of third-party data into their research activity a form of open science and celebrate this cooperation as a close coupling with the domain of innovation. However, more dogmatic scientists will argue that this cooperation is at odds with the open science principles, because the data is only available to those scientists who have licenced it and not to everyone else. From their perspective, the transaction is a coupling of open innovation and closed science.

When policy initiatives fail to acknowledge such incongruence, we can expect activist academics to try and mobilise resistance against the coupling. In the above mentioned example, when the European Commission announced that the publishing corporation Elsevier had been awarded a subcontract to monitor the development of open science in Europe, open science activists filed a formal complaint to the European Ombudsman regarding this decision (Tennant, 2018). One of the activists' fears was that Elsevier would not make all of the data they collected as part of this job openly available. In other words, the activists assumed that the firm would follow the open innovation logic of selective revealing rather than the open science principle of universal transparency. If unsuccessful with this kind of resistance, we can expect activist academics to stop voicing their concerns and exit the movement (Hirschman, 1970).

What would be the consequences of alienating the dogmatic activist academics from the open science movement? One way to answer this question is by looking at a comparable case. In the late 1990s, part of the growing Free Software movement rebranded itself as the Open Source Software movement. In contrast to the Free Software movement, the Open Source Software movement championed a more pragmatic interpretation of the movement's initial definitions and principles. By doing so, it managed to enrol commercial firms in this alternative approach to software development and distribution, making Open Source Software a relevant alternative to many types of closed source software. On the one hand, breaking free from the dogmatic core of the initial movement has allowed the Open Source Software community to popularise this type of software tremendously around the world. At the same time, this movement has reduced the broader philosophical agenda of the Free Software movement (freedom of expression needs to be maintained for all forms of expression, including expression through computational means) to a new economic model of software production and distribution (Hippel & Krogh, 2003).

This historical example suggests that if focal members of the open science movement become alienated through a close coupling with open innovation, the transformation of science might change its trajectory. On the one hand, an alienation of dogmatic open scientists makes pragmatic collaborations between academic researchers and private firms more likely. For example, firms and researchers can more easily establish semi-open open data partnerships (data is openly shared with those actors involved in the partnership) when there is less criticism of the fact that this kind of cooperation excludes other potential users of the data and cannot therefore be considered 'open'. On the other hand, an alienation of core activist academics can make some forms of transformation within the domain of science more difficult. For example, losing activist members of the open science movement might make it difficult to perform radical and risky 'journal flips' from closed access to open access models (Fecher & Wagner, 2015). Such journal flips allow the scientific community to break free from profit-seeking academic publishers and

transition to forms of publishing that are less or not profit-oriented at all (e.g., university-led publishing). Transitioning a journal from a for-profit to a non-profit publisher is beneficial for science, as it frees resources. However, transitioning a journal is also a risky endeavour for the editorial board, as complications during such a transition can disturb the well-functioning community around an established academic outlet. From what we know about journal flips so far, editors who take the risk of a transition usually embody a rather dogmatic understanding of open science and are not willing to come to a pragmatic compromise with for-profit publishers.

Marginalising maintenance work

A close coupling with open innovation might marginalise collaborations between science and practitioners that are not geared towards innovation. Many cooperations between science and practitioners are oriented towards values of maintenance, care, and repair (Graziano & Trogal, 2019; Russell & Vinsel, 2019). A typical example are archives that, together with researchers, make their collections available online and under open licences. It is maintenance work, it is valuable for both academia and society, but it is not innovative. In times of growing concerns regarding the psychological and ecological viability of globalised capitalism, an orientation towards maintenance work seems at least as important for a sustainable future as an orientation towards innovation. The main mechanism through which a close coupling of open science and open innovation might further marginalise such forms of maintenance work is via the allocation of research funding. In the introduction to this essay, we pointed out that proposals to closely couple open science and open innovation are being advanced by institutions such as the European Commission or think tanks that focus on matters of science policy. When these proposals turn into corresponding funding programmes (e.g., through national science funders or the European Research Council), research projects that are unable to demonstrate innovation-related relevance will find themselves at a competitive disadvantage against innovation-related projects.

When research funding emphasises innovation at the expense of maintenance, this can lead to two outcomes at least. First, it marginalises cooperations between certain academic and practical fields. For example, in the humanities and social sciences, there has been a recent surge of collaborations between open scientists and practitioners that focus on maintenance and care rather than innovation. Under the label 'Open GLAM', academics from the humanities collaborate with galleries, libraries, archives, and museums with the goal of providing access to and maintaining cultural artefacts (Blagoev et al., 2018; Passel & Rigole, 2014). Collaborations that are focused on maintenance and care rather than innovation can also be found in the life sciences. A recent example is a collaboration between the Public Library of Science (PLoS) and the World Health Organisation (WHO). During the onset of the global Covid-19 crisis in early 2020, all seven PLoS journals pledged to forward all submitted manuscripts related to Covid-19 directly to the WHO in order to support their global crisis management (simultaneous to sending the manuscripts out for peer review) (Heber, 2020). Second, it can lead to an 'Icarus paradox' (Miller, 1992) in which research domains that are already strongly oriented towards innovation (sometimes referred to as 'applied science') double-down on new projects and thereby struggle to maintain their already existing

projects. In IT-oriented firms, a similar phenomenon has been described as the rise of 'zombie projects' (Anthony et al., 2015), which are neither completed nor discontinued and strain individual employees as well as firm performance. By and large, making room for research-practice collaborations oriented towards the maintenance (or even the discontinuation) of existing projects and infrastructures might lead to more societal benefits than constantly starting novel projects for the sake of innovation.

Creating resource dependencies

A close coupling between open science and open innovation can lead to new resource dependencies, which limit the autonomy of the scientific community. This point is more speculative than the previous ones, but a thought experiment can help us get this idea across: In a closed co-operation between scientists and a firm, both parties might agree to work together temporarily in a clearly defined project. For example, in exchange for access to a rare dataset, researchers perform some extra analyses that do not help them in their primary scientific inquiry but are relevant for the firm's innovation activities. Due to the temporal limitation of the project, scientists retain their capacity to conduct research independently of the firm (e.g., by maintaining their own laboratory equipment).

However, the proposals for a close coupling between open science and open innovation, which we discussed above, implicitly suggest a longer standing relationship between the two domains. The underlying rationale between these proposals is that some scientific activities (e.g., data collection) are performed right now by both firms and academic researchers. Openness between science and the R&D departments of firms would allow research institutions to use this data 'downstream'. The consequence of such a close coupling would hence be that scientists do not need to maintain the capacity to collect their own data anymore. On a societal level, this development can be portrayed as a more efficient use of scarce resources. However, when zooming in, we see that such a close coupling would make research communities dependent on the interest and assumptions of non-science actors. In the literature, this scenario has been described as the transformation of science along the logics of platform capitalism. While previous work has explained this 'Uberization of science' (Mirowski, 2018, p. 196) by theorising links between the notion of openness and the neoliberal ideology of market fundamentalism, we believe that these developments may be caused by policy programmes that explicitly try to link the domain of science closer to the domain of innovation.

Conclusion

Both policy-makers and researchers have recently called for a closer coupling of open science and open innovation. In this essay, we have contrasted the historically-specific definitions of openness in science and innovation. This comparison helped us to anticipate three unintended consequences that such a close coupling might have for the domain of science. Reflecting upon these consequences, implications for both policy-makers and researchers become apparent.

For *policy-makers*, the implications of our study depend on the policy domain. For science policy, our study suggests that the allocation of resources towards open science

projects should not be contingent only on promises to enable innovation but should also allow for science-practice collaborations that aim at societal objectives like maintenance, care, or repair (Graziano & Trogal, 2019; Russell & Vinsel, 2019). For example, science policy should allocate resources not only for the development of new but also for the maintenance of established technological infrastructures that underpin open science practices. Instead of coupling open science activities to innovation-oriented projects only, they could also be coupled to the maintenance and curation of platforms for Open Educational Resources, or open collaboration projects such as Wikipedia. Science policy should also allocate resources for the diffusion of open science practices across academic institutions, not only to those projects that promise to create novel open science practices. On a societal level, the diffusion of open science practices contributes to the common good as much as innovation-oriented projects do. One policy programme that this recommendation directly addresses is the EU's scientific research initiative 'Horizon Europe', which was presented publicly in March 2019 and is scheduled to launch in 2021 (European Commission, 2019). The initiative promises a strong focus on open science (e.g., through an open science policy for funded research projects) as well as a focus on open innovation (e.g., through support for a European innovation ecosystem). We believe that while both pillars of the research initiative are intended to address grand societal challenges, EU policy-makers should be cautious when expecting that this goal can be reached best by closely coupling both domains.

For industrial and economic policy, our study suggests that rather than trying to establish shared definitions and standards of openness between industry and academia, industrial policy should revisit disclosure requirements for large data-hoarding firms (Zuboff, 2019). As recent work demonstrates, the current dynamics are gradually shifting scientific research away from academic institutions inside the boundaries of firms (Hartmann & Henkel, 2020). Rather than progressively coupling science and innovation, economic policy-making therefore ought to reassess whether measures should be taken to carefully decouple research on emerging technologies from the strategic objectives of powerful technology corporations.

The implications made for *research* by our study depend on the researchers' primary matters of interest. For researchers interested in scientific practices and the changing role of science in society, our study suggests that more attention should be paid to forms of collaboration between science and non-science actors that are not aimed at innovation. Better understanding these types of coupling will ultimately yield a better understanding of the specificities and opportunities of a more selective coupling between open science and open innovation. For researchers interested in open innovation, our study suggests that unpacking the different ways in which people in organisations claim, configure, and contest openness in their everyday activities might generate new and unexpected research findings. In recent years, the open innovation community has been highly successful in identifying more and more domains of organising as cases of open innovation (i.e., government or strategy). Our study suggests that accepting forms of openness in such domains as different (rather than integrating them conceptually) can help the open innovation community to overcome what Mehrpouya and Willmott have called the 'corrosive effects of knowledge branding' (2018, p. 730) and secure the future relevance and provocative quality of their research.

Probing ways in which open science and open innovation can contribute to the mitigation of societal problems such as 'post-truth populism' is a responsible path that has recently been taken by policy-makers (Blümel et al., 2019) and researchers (Beck et al., 2020; Smart et al., 2019) alike. However, assuming that such problems are tackled best when closely coupling science with innovation overlooks the different ways in which they have opened up in recent years. Only when aware of the different ways in which openness is defined and mobilised in science and innovation can researchers and policy makers reorient these domains towards societal problems without turning the concept of openness into a problem in itself.

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ORCID

Maximilian Heimstädt http://orcid.org/0000-0003-2786-8187
Sascha Friesike http://orcid.org/0000-0002-9314-5633

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