

Review of “Demystifying academics to enhance university-business collaborations in environmental science” by Hillier et al.

Summary

This is a thoughtful and well written paper that attempts to shed light on both what motivates and constrains a typical UK-based early- to mid-career environmental scientist, and uses this intelligence to help understand how industry-university collaborations might be enhanced. The co-authors draw on their first-hand experiences, supplemented by carefully selected textual data and the outcomes of a participatory workshop. Perhaps most usefully, the paper presents two lists of practical and short-term measures through which industry practitioners can develop a relationship with an academic partner and *vice versa*.

General comments

1. **Context:** The paper gives no real context in terms of how (UK) environmental scientists currently engage with industry partners (i.e. collaborate, receive funding), both in terms of proportion (how common it is) and typical time commitment (how much time is dedicated). Such an assessment, even if brief, would provide a useful illustration of the current situation. While I am not aware of any references that have directly collected such data, there may be other (perhaps more quantitative) strategies that provide a sufficient proxy measure (e.g. proportion of NERC grants awarded that have included industry partner, proportion of published papers in a specific discipline that include industry partner as co-author or industry funding), perhaps with direct approaches to the academics in question to gather a ballpark estimate of ‘average’ time commitment. Some ‘top-down’ assessment such as this would provide an interesting (and hopefully corollary) counterpoint to your current largely ‘bottom-up’ approach.
2. **International perspective:** The paper attempts to include an international perspective on many of the issues covered, but I felt at times that this disrupted the main narrative of the paper. I would suggest that the occasional paragraphs discussing international perspectives are removed; I do not believe this would impact on the quality of the paper as it is evidently and usefully a UK-focussed account. Alternatively, there could be a dedicated section towards the end of the paper that provides all international perspectives in one place (rather than them being dispersed through the paper).
3. **Part-time academics:** The environmental scientist persona is (implicitly) a full-time post. While the majority of UK academics are full-time, there is a small but significant proportion of academics that work part time (~33%, see <https://www.hesa.ac.uk/news/18-01-2018/sfr248-higher-education-staff-statistics>). Part-time researchers would be expected have a reduced range of responsibilities commensurate with their reduced hours, but this might be expected to limit their time available for industrial collaboration to an even greater extent than for full time staff. It

would be useful if you could provide a brief commentary on the additional issues surrounding part time academic contracts, and if they were considered as part of this study?

4. **(Conceptual) pie chart of time constraints:** On p17, lines 23-28 you discuss prioritisation of time and that adding a new task requires discarding of an existing one. I feel this could be a very useful concept more widely in your discussion of time constraints. An academic does not have an endless list of tasks (as your table perhaps implies), but rather has finite time (i.e. a pie chart) that must be prioritised into different activities (segments of the pie). It would perhaps be informative if you were able to present the information shown in Table 2 as a pie chart, at least conceptually, with different segments representing the competing demands on a academics' time. This should illustrate more clearly how only 0.5 days per week are available for industrial collaboration, or how finding time for new collaborations necessarily requires other tasks being reduced in time or omitted.
5. **Access to published work:** On p20, lines 1-5 you advise industrial practioners to check "that there isn't already an answer to your question in the research literature?". From my experience, this has been (and remains) a barrier between industry and academic research as industrial practioners in many fields do not routinely have access to academic journals behind paywalls. This both prevents them reading about new science and also reduces their incentive to get work published (as their peers would not necessarily see or benefit from it). The rise of open access publishing is changing this, but some discussion of the how the traditional academic publishing model can create a divide between universities and industry might be helpful in this context.
6. **Academic impact – improved methods/data/results:** On p21, lines 15-33 you outline some of the types of impact that can be demonstrated. A notable omission from this list is how academic involvement can improve the methods/data/models/results being used by industry practioners. Although this ultimately may lead to increased profitability, the other benefits of such improvements (e.g. time savings, reputational benefits) are such that I believe it deserves to be listed as a specific impact in your list. In your insurance setting, examples might include improvements to the flood model, baseline topography or property database being used to assess properties at risk.
7. **Academic impact – time lag:** There is no discussion of the fact that while a published paper can be 'recorded' immediately, there is often considerable time-lag before other impacts can be properly assessed (e.g. time to implement changes across a business, time to (re)train staff, time to quantify cost savings), which can be hard to reconcile with in some cases relatively short term academic decisions/appraisals/funding/etc.

8. **Motivation of industry:** There is little commentary of what industry are looking for from collaboration with universities. Although the stated purpose of the paper is to give insights from the academic's perspective, it is hard/impossible to divorce this completely from the motivations and needs of industry. From my experience, the nature of industry requirements in some cases can be (perceived as) such that there is limited appetite for research scientists to engage, even if they did have the time (e.g. low-risk non-innovative solutions, short time timescales, pressure to produce results).
9. **Institutional-scale responses:** The paper generally focuses on collaborations that are established and maintained at individual-scale. However, there are university/department-scale responses that are intended to facilitate industrial collaboration (e.g. dedicated 'industrial liaison officers' such as www.bristol.ac.uk/engineering/ilo/academics/, industrial-funded academic positions, funding institutional facilities, etc). It would be good to have some discussion of if and how such initiatives influence or change the papers' findings.

Specific comments

10. **p3, line 4:** I would suggest that it is "knowledge" that is produced rather than "science".
11. **p4, line 26-28:** It is not clear to which reference the gold/puzzle/ribbon classification is being attributed (Lam 2011 or Stephan and Levin 1992).
12. **p7, line 28:** Suggest that sect 2.1.2 does not start with a question. I suggest this question is either simply deleted or rephrased into a statement.
13. **P9, line 5:** "a guide for academics to their academic partner" – it is not clear to me what this statement means?
14. **p11, line 29:** "...only a sub-part of this." This is tautologous; I suggest "subset" or "part"
15. **p13, line 1:** "..., then winning..." – This would read better as "..., followed by winning..."
16. **p16, line 2:** "trusting" – This is perhaps better described as "trust-based"
17. **p16, line 14:** "65-89% of university scientists..." – this seems are very precise range, which stands out all the more as it starts the paragraph. It might be better to state a more descriptive range here, e.g. "At least two thirds..." or "As many as 90%..."
18. **p17, line 3:** "...days and days to sit, gazing around and pondering..." – this feels too colloquial. Perhaps "...significant 'thinking time'..." or "...time to engage in deep thought on blue sky research questions.

19. **p18, line 5:** "...from tight expectations..." – "strict" or "rigid" might be a better word than "tight" here
20. **p18, line 14-15:** "Thus, there is some need for continuity, which may be perceived as 'pet projects' by industry. – It is not clear what is meant by "pet projects" and no further explanation is given? And why is this a problem? A contrary perception is that it creates world leading scientists in their specific field.
21. **p19, line 8:** "...a scale they could otherwise only dream of?" – Rather colloquial. Suggest "...a scale not otherwise possible?"
22. **p23, line 5:** "buy a post-docs time" – Colloquial. Suggest same phraseology used as on p13, line 2 ("by funding a post-doctoral researcher").
23. **p24, figure caption:** "...and 3 main motivations after 'gold' discounted are in italics" – I do not understand what is meant here? I can only see two further motivations in italics ('utility' and 'altruism'). I would like to see how 'puzzle' and 'ribbon' map onto these relationships too.
24. **p24, line 9:** See comment 13
25. **p26, line 11:** While I agree with the sentiment, "Brilliant!" is not the best way of starting/explaining this step. Can this be reformulated as a statement/sentence (e.g. "While this is perhaps the ideal scenario for many academics, the sums....").
26. **p27, line 14:** "Ways research scientists might provide support to their risk practitioner partner:" – I am not clear whether this is meant to be a sentence (in which case it should be reworded) or a section heading (in which case it needs re-formatting)

Technical comments

27. **"ise" or "ize":** There is some inconsistency between these two spellings though the manuscript.
28. **p4, line 26:** Punctuation needs correcting "...into , 'gold'...".
29. **p13, line 4:** Missing "are" between "outcomes" and "also"
30. **p14, line 5:** Missing apostrophe after "academics"
31. **p14, line 9:** Should be "nor" rather than "or"

32. **p16, line 13:** Delete apostrophe.

33. **p21, line 6:** "UK's 7 yearly" should be "UK's 7-yearly"