Early career researchers and the pandemic

A study on changing ECRs' employment status, careers and scholarly communication behaviour and attitudes

1.0 Research Questions and Significance

1.1 Summary

The University of Tennessee Center for Information and Communication Studies, together with CIBER Research in the UK and collaborating university partners from China, France, Poland, Malaysia, Spain and Russia (Appendix 1 for names of individuals) propose to continue and extend the longitudinal work CIBER have conducted with early career researchers (ECRs) about their work lives, their prospects and scholarly communication behavior, **with the express purpose of finding out what the consequences of the pandemic are for the scholarly community** as seen through the lens of tomorrow's future professors and leading scientists and social scientists. CIBER and their partners propose a two-year long study, which will comprise repeat interviews with around 160 ECRs from the sciences and social sciences, capped by an international questionnaire to scale up the interview findings on a larger and more international and subject diverse population of ECRs. The project will build firmly on the foundations of the recently completed four-year Harbingers[1] study of ECRs in the sciences and social sciences (2019). Personnel will continue interviewing as many of its original participants as possible, and employ its tried and tested methodology as well as an adapted form of its interview schedule and survey questions.

The longitudinal nature of the project means that we will not be merely taking a snapshot of a major transition in the scholarly environment, but following and monitoring the process at the grass roots level in order to find out what the new scholarly 'normal' will look like and how the future of science and scholarship appears to be taking shape. The study will especially focus on the impact of the COVID-19 pandemic and whether it is speeding up/slowing down changes already detected in the pathfinding Harbinger study, whether it is giving rise to additional and different changes (or whether some changes are going into reverse), which countries are doing what and where, in these circumstances, lies actual practices. We shall also be building in additional questions about aspects of

---

[1] http://ciber-research.eu/harbingers.html

scholarly communication that have risen in importance as a result of the pandemic, such as open access, data sharing and remote working.

1.2 Importance of the Research

This is a crucial and pivotal time for the scientific enterprise which deserves close scrutiny. Academics do not know what the 'new normal' is going to be, but badly need insight into where things are headed in order to inform, plan and enable intervention. Thus, it is proposed that the longitudinal work CIBER have conducted with ECRs in helping determine whether their millennial beliefs are changing the face of scholarly communication should be continued and extended over the next two years, which also means monitoring the impact of the pandemic and whether it is accelerating change or altering the shape of change. The overarching aim of the proposed project, therefore, is to determine where the scholarly enterprise, as represented by its future generation of researchers, is heading. Are we witnessing the need for conservativeness becoming the overriding consideration in steering research initiatives and an inescapable imperative for those who manage to enter the system? Alternatively, are we on the cusp of disruptive developments in the scholarly undertaking, which may bring about far-fetching changes in scholarly attitudes and behaviors?

2.0 Current State of Research

No one could have anticipated during the 4-year, international, longitudinal Harbingers study (2016-2019) of the changing scholarly communications attitudes and behaviors of ECRs, led by CIBER Research and funded by the Publishers Research Consortium (PRC), the global disruption that the pandemic was about to wreak upon the scholarly world. However, by now the reports coming in from around the world of the extent of hiring freezes and contract cuts in academe (Woolston, 2020) have given rise to a growing concern about the future of the scientific undertaking and the impact this will have on ECRs – the most numerous and in many ways most vulnerable members of the research community. According to the *Times Higher Education* (2020), ECRs' vying for the remaining, very much diminished number of tenure-track positions could lead to a 'lost generation' of young academic researchers and, in result, to long-term damage to research.

The situation threatens to become ever-more untenable, not only on the individual researcher level, but also on the global scholarly community level. As CIBER have found, true to their millennial

2

values and views of openness to change, resilience, respect of diversity and appreciation of multiculturalism (Duffy et al., 2017; FEPS, 2018; Pew Research Center, 2010a, 2010b), ECRs manifest scholarly attitudes and practices that hold the promise of their becoming harbingers of change in the scholarly communications system worldwide (Nicholas et al., 2019; 2020a; 2020b; 2020c). However, the onus on them to bow to the dictates of academia and play by its rules for career-associated reasons (Harley et al., 2010; Schoen et al., 2014) has hindered their efforts in these directions. Today's pandemic-riddled scholarly world poses additional new challenges to rethink and reshape the research system, with its disproportionate weight on narrowly defined research attainments – the volume of papers published in high-ranking journals and the number of citations they obtain – in promotional and funding deliberations (Herman & Nicholas, 2019).

The coming dearth of academic positions may stifle any thoughts struggling ECRs may have about changing the system and may indeed render aspiring scholars ever-more conservative in their scholarly attitudes and behaviors. As trainees seeking to establish themselves in an increasingly competitive environment, it may be patently unwise for them to put to practice any 'revolutionary' notions they might harbour. After all, they have to adopt the behavioral norms of groups they seek to join; they need to learn what new group behaviors and values are required; and they need to demonstrate them to show they have 'what it takes' to be a potential member (Cusick, 2015).

Perhaps not. As Subbaraman (2020) suggests, the pandemic could highlight the importance of science and collaboration and spur long-term support, especially for basic research, much as the Second World War did. It is just conceivable then that in a world where the scholarly endeavor assumes an ever-more significant role, rather than succumbing to the fate of becoming a lost generation of researchers, today's millennial ECRs, with the open-mindedness and resilience so characteristic of their generation, will change the system from above, on the policy-making level, but also from within. If so, then their scholarly views, more revolutionary than those of their senior counterparts (Nicholas et al., 2019; Nicholas et al., 2020a, 2020b), may finally come into fruition. For example, ECRs may see fit to make much more headway than before in the adoption of Open Science practices, with high levels of transparency, accessibility and collaboration, for these would enable a

more successful individual-level building of reputation, whilst also affording more effective, efficient attainment of scientific advances.

3.0 Proposer's Qualifications

The team members from University of Tennessee (UT) and CIBER Research, Ltd. (CIBER) are well-qualified to lead this project, as they all have a long and distinguished history of conducting research on scholarly communication and information behavior.

At UT, PI Carol Tenopir, Chancellor's Professor and Interim Director of the School of Information Sciences (SIS), is a world-renowned researcher who is the author of five books and over 200 journal articles on the topics of information access and retrieval, electronic publishing, and the information industry. Co-PI Suzie Allard, Chancellor's Professor in SIS and Director of the Center for Information and Communication Studies, has earned top honors for her research on the ways scientists and engineers use and communicate information. Both team members served as co-investigators and members of the Leadership Team for DataONE, an NSF-funded cyberinfrastructure project for environmental science information, as well as led multiple grant projects from IMLS and other sources that have educated the next generation of science data professionals. Dr. Tenopir and Dr. Allard have also worked with Co-PI David Nicholas on a previous research grant funded by the Sloan Foundation from 2012 to 2013, a 15-month study of research academics in the US and the UK that studied how scholars implement trust and authority in their scholarly activities.

Co-PI David Nicholas is the director and co-founder of CIBER Research, Ltd. Formerly the Director of the Department of Information Studies at University College London and Head of the Department of Information Science at City University in the UK, Dr. Nicholas has been principal investigator on 60 research projects and published over 500 articles, reports and books on the subjects of scholarly communication and information seeking behavior. Dr. Nicholas is currently an Adjunct Professor in the School of Information Sciences at UT. From 2015 to 2018, Co-PI David Nicholas and his team carried out a world-wide, longitudinal study commissioned by the Publishing Research Consortium to find out the extent to which ECRs are the harbingers of change in the digital world. This project provided a comprehensive assessment of the behaviors and attitudes of ECRs as they

interact with the scholarly communication system, and identified areas of strengths and weaknesses as well as opportunities for change. This research study provides the basis for the proposed research project, which will expand on the findings by examining the consequences of the pandemic for the scholarly community as experienced by ECRs.

The wider project team includes collaborative university partners from China, France, Poland, Malaysia, Spain, and Russia. Many of these team members, including Anthony Watkinson, Eti Herman, Jie Xu, Abrizah Abdullah, Blanca Rodríguez-Bravo, Chérifa Boukacem-Zeghmouri, and Marzena Świgoń, were part of the research team, along with Dr. Nicholas, for the original Harbingers study. These team members have varied and diverse backgrounds and areas of expertise, including digital libraries, information behavior, scholarly communication, the needs of ECRs, emerging models of publishing, scholarly reputation indicators, library and information science education, e-books usage, knowledge management, social media, and others. These team members will provide invaluable advice and feedback at all stages of the project. Their individual qualifications are listed in more detail in the CV document attached to this proposal.

4.0 Research Methodology and Justification

4.1 Overview of Methodology

We intend to continue the mixed method methodology of the Harbingers study (Nicholas et al. (2019; 2020b), which enables a high-degree of data triangulation: an ongoing literature review, focus groups, deep, open-ended interviews and a questionnaire survey.

An ongoing literature review and analysis will be launched at the very start of the project, followed by a series of national focus groups with small groups of ECRs to test and assist in question framing. Once the interview schedule is finalised, the longitudinal interview study will commence, covering around 160 science and social science ECRs from China, France, Malaysia, Poland, Russia, Spain, UK and the USA. The ECRs will be repeat interviewed three-times, so as to monitor closely their perceptions and behaviors at these times of pandemic-associated changes of great speed and intensity, which are likely to affect those in precarious positions, such as ECRs, more than others.

The sample will be a hybrid one, comprising both ECRs who participated in the Harbingers research project, and new ones, recruited to fill the ranks of ECRs who have left research or no longer qualify as ECRs (because they obtained tenure, for example). New ECRs, as before, will be recruited by our national interviewers, utilizing their local research networks and connections, with their numbers supplemented by mail-outs from scholarly publisher lists and ECR social networks. Each national interviewer will be provided with a quota of interviewees in order to ensure representativeness from an age, gender and subject standpoint and to ensure that the demographics of national samples will be as similar as possible. In order to allow for drop-outs, which past experience tells us is less than 10 percent, we shall over-recruit, to the extent that there will be 22 ECRs in each country sample.

The remotely conducted interviews will typically be 60-100 minutes in duration, and will be open-ended in order to give ECRs full rein and provide the space to describe things in their own words. Towards this purpose, the interviews will also be conducted in the languages of the particular countries involved, where appropriate. The record of the interview will be checked with the interviewee, a practice which not only gives an opportunity for follow-up questions but ensures accuracy, too.

The concluding questionnaire survey, designed on the basis of the interview-stage data, will be pilot tested and distributed online via SurveyMonkey. It will be made available in English, Chinese, French, Polish, Russian, and Spanish. As there is no single sampling frame for ECRs or even a universal definition (the two are related), a broad-brush approach to dissemination will be adopted, with the questionnaire distributed via national social media networks of researchers, academic publishers, social scholarly networks and key ECR platforms (e.g. Eurodoc, Voice of Young Science). We will aim for a minimum of 3000 respondents.

4.2 Lines of Inquiry/Areas of Questioning

Nearly all of the elements/topics explored in the previous project, as delineated in the interview schedule and the survey questionnaire, will be explored in the proposed project. These topics of discussion provide the very template of ECRs' work lives and communication behavior and, as such, will give us the opportunity to map change, as well as ensure nothing is missed or needs to be second guessed. Much of the original questioning is open-ended, so there is flexibility built-in. Thus, there will be questions on: ECRs' demographic background, jobs, careers, reputation as well as more than 20 scholarly communications aspects, including discovery and access, authorship practices, peer review, publishing strategies, open access publishing, open data, sharing, collaboration, social media, metrics, research impact, libraries, publishers, and scholarly transformations. (See the full list at http://ciber-research.eu/download/Year3-InterviewShedule.pdf). The great advantage of continuing with the original comprehensive interview schedule, albeit in adapted form, is that we will have the opportunity to observe communications in the round. Otherwise, it would be impossible to know definitely where change is occurring, especially as there is often a knock-on effect because communication practices can be brought on by a variety of factors; open access is a prime example. Full interviews will also enable us to follow the train of events over six years, which will surely put us in a unique research position, especially as the findings, as noted, will be re-visited and made generalizable in the final, survey stage.

Inevitably, there will be additional lines of enquiry, too. Pandemic-induced developments in the various topics under consideration will likely require adapting the original questions and moving them around as well as putting more focus on certain topics, asking for more detail and possibly greater prompting in places. Although judging from the ongoing discussions in the press and on social media, the pandemic seems to have brought about the acceleration, or, conversely, the slowdown if not freeze of existing trends, rather than the introduction of novel ones, we will prompt our ECRs for evidence on disruptive developments. In order to accommodate all this in an already lengthy interview, we shall consolidate some of the original questions in areas where change is less likely to occur, such as discovery. Any changes to the questioning will be tested at focus groups with ECRs in collaborating countries and the interview schedule will be adapted accordingly. By the same token, the survey questionnaire will build on the interview data.

From a scan of the recent literature the following topics/lines of inquiry suggest themselves as warranting special attention and questioning, although this is not an exhaustive list and focus groups will suggest more no doubt:

1. **Open science**. During the pandemic publishers have provided open access to COVID-19 research papers, a move that has obtained much publicity in and outside the biomedical fields. The crisis has also inspired experiments in speedier and arguably more efficient peer review. Have such initiatives changed perceptions in the scholarly world in any way, indeed, fast-forwarded open science practices? Have there been more general moves to publish gold OA or green OA? What role have ECRs played in these developments: have their data/publications been among those provided OA, have they decided to opt for OA publishing on their own initiative and have they participated in novel peer reviewing processes? How instrumental do they consider their preferences/values to have been in the developments in these directions if and when they occurred?

2. **Peer review and scientific integrity**. The arguments over ways of dealing with COVID-19 have brought to public attention how science is actually done and in particular the role of peer review. How are "false facts" recognised and why have there been so many retractions of articles and preprints?

3. **Publishing/dissemination.** Researchers have been shown to use pre-print servers to disseminate more quickly papers relevant to COVID-19, and were at times even required to do so by their publishers as part of the efforts to make coronavirus research free to read. Has the practice spread to areas not directly related to the pandemic? Have ECRs adopted the practice, and if so, was it on their own initiative? What were their reasons/purposes in doing so? To what extent do they see pre-print servers taking the place of journals? Will this rejuvenated mode of research dissemination breathe new life into these platforms and/or possibly into alternative options, such as EU and Wellcome publishing platforms, too? Also, and related, during the pandemic, researchers have access to research in progress being displayed on platforms and debated on social media among peers, politicians and citizens.

Has this state of affairs brought about a change in their attitude to altmetrics? How useful do ECRs consider the ability to witness scientific activity in real time?

4. **Remote working.** With little, if any, international travel or face to face meetings there has been greater use of social media platforms and video conferencing in scholarly circles. What are the consequences of the increased practice of remote working for inexperienced and less well-connected ECRs? How, if at all, have travel restrictions impacted their collaboration, co-operation and networking opportunities? Have they encountered any problems created by the greatly diminished possibilities for informal communication (conferences and even water cooler conversations) with peers and/or senior colleagues, or have social media platforms become viable alternatives? How have remote working and social distancing affected field/laboratory research? How have safety considerations impacted research work? What generally has been the experience of working from home for ECRs, how did they organise their life and work? Gender differences need to be examined as well, to identify any disparities in the ability to balance life and work due to different expectations of childcare and housekeeping duties.

5. **Research workhorses.** ECRs have been shown to be in the engine room of most research projects, undertaking numerous critical research tasks. Has this changed as a result of changes in status (more positively or negatively) and reorganizations that have been undertaken in the labs, universities etc. as a result of increased financial pressures? Have travel limitations and virtual rather than in-person meetings restricted or leveled the playing field for ECRs? Has the pressure on them to publish as much as possible as quickly as possible accelerated because of the competition for the reduced number of tenure track positions or, conversely, has this pressure become somewhat diminished with tenure clock extensions put in place at many universities? Has the greater emphasis on the need to reach out to the community to explain COVID-19 related scholarly information influenced their views and activities?

6. **Has research stalled/altered?** Has the pandemic hindered or accelerated scholarly communication? Has it hindered or accelerated scientific progress? Has research changed its focus from international to national interests in order to solve the economic problems of a

post-pandemic world? If so, how have researchers experienced this change in pace/focus and what advantages, or disadvantages, do they see in this state of affairs? Are there any impacts which are more specific to ECRs than to other cohorts?

7. **Are there disciplinary losers and winners**? Comparisons between disciplines will be interesting, because there is more money going for medicine and the biological sciences from a possibly shrinking research pot.

8. **National diversity**. As with the virus itself, it would be good to see how various countries and ECRs of international backgrounds fare and deal with the demands put upon them. Beyond that, how do ECRs experience the COVID-19 driven global scholarly world: have the rich become richer and the poor even poorer? How do developed/developing countries fare in result? How have international collaborations been affected?

9. **Libraries.** How do ECRs perceive the need for libraries and how do they use them in an ever more disintermediated and remote research environment? Similar questions can be asked about publishers.

4.3 Justification of Participants: Early Career Researchers

ECRs provide a powerful lens through which to investigate the scholarly communications system. The Harbinger research showed that they are authors undertaking most of the fundamentals, such as data collection, searching, discovery, and referencing; reviewers (often as proxies for their mentors); and sometimes sit on editorial boards and lead research groups (Nicholas et al., 2019). As a result, they provide a critical perspective on how research practices are currently changing and how they may continue to change in the coming years.

Early career researchers is a term variously defined by universities, funders, and national government bodies, but many (for instance, the UK Research Councils) tend to define them by the number of years since completing a PhD, typically 10 years, which is effectively a definition based on relative 'newness' or 'juniority' in the job. However, this particular definition is not fit for our purpose as we are primarily interested here in the new wave of youngish, untenured researchers, who might be postdocs or be undertaking a PhD at the same time as they are working on a funded research project.

Thus, in consultation with the international research team (eight countries) a consensual definition was adopted for Harbingers which works internationally:

'*Researchers who are generally, but not exclusively not older than 35 who either have received their doctorate and are currently in a research position or have been in research positions but are currently doing a doctorate. In neither case are they researchers in established or tenured positions*.'

Clearly some of the original Harbinger participants may be by now older than 35 (having aged by 4 years), but it is quite conceivable that they are still definable as such because of diminishing opportunities for tenure, so that the original definition of ECRs will need to be applied with a measure of flexibility. In any case, we are open to discussions on the merit or otherwise of our definition of the term ECR.

4.4 Geographical scope of the study

Proceeding from the notion that it is important to revisit the same countries as the Harbinger study in order to enable valid comparisons, the interview element will focus on eight countries: China, France, Malaysia, Poland, Spain, UK, USA and Russia. It is a convenience sample, based on the availability and co-operation of senior local researchers in these countries, but also chosen with the express aim of enabling the representation of: (1) both big and small countries; (2) both developing and developed nations - inclusive of the world's research powerhouses; (3) a wide variety of locations in Europe, Asia and North America; (4) a wide range of languages, including many of the world's most popular ones. Indeed, while only seven countries were covered (Russia was added in the last year of the study), an analysis of Scopus data at the time showed that they accounted for 50% of all papers published in 2016 (CIBER, 2017). With the inclusion of Russia that percentage has increased.

As with the Harbingers study, the questionnaire survey proposed will be truly international, and, of course, its triangulation with the interview data will be of special interest. We will be particularly interested in determining whether the situation in Africa, the Near East and South America are any different. A developed vs developing countries would be a very interesting analysis, too.

11

Of course, we shall also be tracking pandemic spread and response in these regions as well (in order to facilitate the generalization of findings to other "matchable" regions). This would be the main context for the findings. There is a huge amount of data available on the spread of the pandemic and the measures taken in the different countries in response, and the team will be able to provide more detail on local responses. We shall try and identify patterns of developments in scholarly communications as they unfold in response to the pandemic, along the lines of how different countries responded to the various challenges, and with what results, which, then, can possibly be generalizable to other countries experiencing similar circumstances. In particular, we will try to establish if there is a pattern to the developments in the scholarly enterprise in countries hit hard by the virus and responding by lock down, so that normal communication is hindered and the economy is struck down.

4.5 Subject scope of the study

The disciplinary spread of the Harbingers ECR interview sample was approximately three-quarters science (a third, in fact, came from the biological and health science) and a quarter social science, roughly reflecting the greater numbers of science ECRs, but also expressing the greater interest of our original funder (PRC) in the sciences. The table below gives more details on the subject spread and a more detailed listing can be found at CIBER (p 70, 2017).

Harbingers ECRs by subject (n=116)	%
Biological sciences and agriculture	22
Medicine and health	13
Engineering and technology	10
Chemistry	9
Computer science	9
Physics	7
Psychology	5
Other sciences	7
Other social sciences	19

If the principal requirement is to strengthen links with the Harbingers study, so enabling comparisons to be made over time, it would make sense to carry on with these proportions. What complicates matters, is that we also want to return to those Harbingers interviewees who are still available and definable as ECRs and we cannot know for sure at this stage how many of the original ECRs will be with us, but there is a likelihood that there will be more from the sciences still. In any case, although the Harbingers study found discipline to be a very important variable in this context, given the relatively small number of ECR interviewees, comparisons will really only be significant at a relatively broad level (in the sciences, for example, health sciences, life sciences, physical sciences). However, the questionnaire would allow a high degree of granularity and a more comprehensive subject coverage. That is its purpose. Nevertheless, it might be good to obtain a better balance among the interviewees between researchers in the hard and the soft social sciences, as the former are nearer in their practices to researchers in the sciences. We shall also be alert to differentiating between researchers from lab-based experimental, field and theoretical sciences.

5.0 Work Plan

Building as we are on the foundations of a recently concluded project, we are capable of making a quick and timely start, which is clearly important given the dynamics of the current situation. The initial literature review, conducted for this proposal will be conducted throughout the project.

- September/October 2020. An initial, wide-ranging literature review, to lay the foundations for the project. The literature will be monitored closely throughout the project.

- October 2020. Focus groups to test interview schedule.

- Interviews to explore ECRs' views at the following points in time but at roughly 6-7-month intervals:

    - October/November 2020, during the pandemic, while things are still very much alive.

13

- Early Summer 2021, right after the pandemic, by which time, hopefully, things have calmed down.

- Spring 2022, when things are likely to be more or less returning to normal.

- Mid-Summer 2022. International survey.

6.0 Deliverables

A summary of progress (highlight report) will be provided, either written or verbal, as required. Interim reports will be provided at the conclusion of each round of interviews and the final survey. A final report of the interviews and survey data will be provided at the end of the project. Given the timely nature of the data we will publish as we go (as we did for the Harbingers study – see Appendix 2).

7.0 Other Sources of Research Support

No other funds have been provided or requested for this project.

8.0 Status of Previous Sloan Grants

1. From 2015 to 2018, CIBER carried out a worldwide longitudinal study on ECRs, the Harbingers Research Project, that investigated the impact of open access publishing, social media and online networks on the process of reputation building. Funded by the Publishing Research Consortium and led by PI David Nicholas, the international research team included: Anthony Watkinson, Eti Herman, Jie Xu, Abrizah Abdullah, Blanca Rodríguez-Bravo, Chérifa Boukacem-Zeghmouri, and Marzena Świgoń. This project will serve as the basis for the research project being proposed. The interview schedules for this project are included as appendices in the Empirical Research Methods document. A list of publications resulting from this study are listed in the bibliography of peer-reviewed papers in Appendix 2 of this proposal.

2. "Trust and Authority in Scholarly Communications in the Light of the Digital Transition" was a 15-month Sloan-funded study of research academics in the United States and the United

Kingdom from 2012 to 2013. The project team included Dr. Tenopir, Dr. Allard, and Dr. Nicholas, as well as other collaborators from the University of Tennessee and CIBER. Using log analysis, focus groups, critical incident interviews, and questionnaires, the research team examined how emerging digital behaviors challenge and change long-held concepts of trust and authority in the world of scholarly research. The full results of this study can be found in the final repot (Tenopir et al., 2013). Along with the final report, a list of publications resulting from this study are listed in a bibliography of products in Appendix 3 of this proposal.

References

CIBER Research (2017). Early Career Researchers. Year 2. Final Report. Newbury: CIBER Research. http://ciber-research.eu/download/20180219-ECR-harbingers-ReportYearTwo-2017.pdf

Cusick, A. (2015). Research training as occupational socialization: Doing research and becoming researchers. *Asian Social Science*, 11(2), 252-261. DOI: 10.5539/ass. v11n2p252

Duffy, B., Shrimpton, H., & Clemence, M. (2017) *Millennial Myths and Realities*. London: Ipsos MORI. Retrieved from

FEPS – Foundation for European Progressive Studies & ThinkYoung (2018) *The Millennial Dialogue: Engaging and Creating a Better Understanding of the Priorities and Values of Millennials*. Retrieved from https://www.millennialdialogue.com/#download

Harley, D., Acord, S. K., Earl-Novell, S., Lawrence, S., & King, C.J. (2010). *Assessing the Future Landscape of Scholarly Communication: An Exploration of Faculty Values and Needs in Seven Disciplines*. Berkeley: University of California Center for Studies in Higher Education, 2010. Retrieved from https://escholarship.org/uc/item/15x7385g

Herman, E., & Nicholas, D. (2019). Scholarly reputation building in the digital age: An activity-specific approach. Review article. *El profesional de la información (EPI), 28*(1), e280102. DOI: 10.3145/epi.2019.ene.02

Nicholas, D., Watkinson, A., Boukacem-Zeghmouri, C., Rodríguez-Bravo, B., Xu, J., Abrizah, A., Świgoń, M., Clark, D., Herman, E. (2019). So, are early career researchers the harbingers of change? *Learned Publishing*, *32*(3), pp.237-247. DOI: 10.1002/leap.1232

Nicholas D., Watkinson, A., Abrizah, A., Rodríguez-Bravo, B., Boukacem-Zeghmouri, C., Xu, J., Świgoń, M., Herman, E. (2020a) Does the scholarly communication system satisfy the beliefs and aspirations of new researchers? Summarizing the Harbingers research. *Learned Publishing*, *33*(2), 132-141. DOI:10.1002/leap.1284

Nicholas, D., Jamali, H. R., Watkinson, A., Herman, Abrizah, A., Rodríguez-Bravo, B., Boukacem-Zeghmouri, C., Xu, J., Świgoń', M., Polezhaeva, T. (2020b). Early career researchers and their scholarly communication attitudes and behaviours: An international survey. *Learned Publishing*, *33*(3), 198-211. DOI: 10.1002/leap.1286

Nicholas, D., Herman, E., Jamali, H.R., Abrizah, A., Boukacem-Zeghmouri, C., Xu, J., Rodríguez-Bravo, B., Watkinson, A., Polezhaeva, T. and Świgoń, M. (2020c). Millennial researchers in a metric-driven scholarly world: An international study. *Research Evaluation*, rvaa004. DOI: 10.1093/reseval/rvaa004

Pew Research Center (2010a) *Millennials: A Portrait of Generation Next*. Retrieved from https://www.pewsocialtrends.org/2010/02/24/millennials-confident-connected-open-to-change/

Pew Research Center (2010b) *Millennials will Make Online Sharing in Networks a Lifelong Habit*. Retrieved from https://www.pewinternet.org/2010/07/09/millennials-will-make-online-sharing-in-networks-a-lifelong-habit/

Schoen, A., Paradeise, C., Cauchard, L., & Noël, M. (2014). A double shift in researchers' activity profiles: An actor-based analysis of the making of quality in high standing academic departments. In E. Noyons (Ed.), Context counts: Pathways to master big and little data. Proceedings of the Science and Technology Indicators Conference, 3–5 September 2014. (pp. 558– 563). Leiden, the Netherlands: Universiteit Leiden.

Subbaraman, N. (2020). *Nature* 582, 164-165. DOI: 10.1038/d41586-020-01519-x

Times Higher Education (2020). HE financial crisis risks 'lost generation of researchers. June 11, 2020. Retrieved from https://www.timeshighereducation.com/news/he-financial-crisis-risks-lost-generation-researchers

Woolston, C. (2020). Seeking an 'exit plan' for leaving academia amid coronavirus worries. *Nature* 583, 645-646. DOI: 10.1038/d41586-020-02029-6

Appendix 1: Researchers involved in the project

1. Professor Abrizah Abdullah**,** Department of Library & Information Science, University of Malaya, **Malaysia**

2. Professor Suzie Allard, School of Information Sciences, College of Communication and Information, University of Tennessee, **USA**

3. Professor Chérifa Boukacem – Zeghmouri, Département Informatique – Bât. Nautibus, Université de Lyon – UCB Lyon 1, **France**

4. Dr David Clark**,** CIBER Research, Newbury, **UK**

5. Dr Eti Herman, Information Science and Library Studies, University of Haifa, **Israel**

6. Dr Hamid R Jamali, School of Information Studies, Charles Sturt University, **Australia**

7. Professor David Nicholas, CIBER Research, Newbury, **UK** and School of Information Sciences, College of Communication and Information, University of Tennessee. **USA**.

8. Professor Blanca Rodríguez Bravo, Biblioteconomía y Documentación, Universidad de León, **Spain**

9. Professor Marzena Świgoń, Faculty of Humanities Institute of Journalism and Social Communication University of Warmia, **Poland**.

10. Galina Serbina, Tomsk State University Research Library, **Russia**

11. Professor Carol Tenopir, School of Information Sciences, College of Communication and Information, University of Tennessee, **USA**

12. Anthony Watkinson, CIBER Research, Newbury, **UK**

13. Professor Jie Xu, School of Information Management, Wuhan University, **China**

Appendix 2: Bibliography of Harbingers project peer reviewed papers

2017

1. Nicholas, D., Boukacem-Zeghmouri, C., Rodríguez-Bravo, B., Xu, J., Watkinson, A., Abrizah, A., Herman, E. & Świgoń, M. (2017). Where and how early career researchers find scholarly information. *Learned Publishing*, 30(1), 19–29. DOI: 10.1002/leap.1087

2. Nicholas, D., Rodríguez-Bravo, B., Watkinson, A., Boukacem-Zeghmouri, C., Herman, E., Xu, J., Abrizah, A. & Świgoń, M. (2017). Early career researchers and their publishing and authorship practices. *Learned Publishing*, 30(3), pp.205-217. DOI: 10.1002/leap.1102

3. Nicholas, D., Rodríguez-Bravo, B., Watkinson, A., Boukacem-Zeghmouri, C., Herman, E., Xu, J., Abrizah, A. & Świgoń, M., (2017). Early career researchers and their publishing and authorship practices. *Learned Publishing*, *30*(3), 205-217. DOI: 10.1002/leap.1102

4. Nicholas, D., Watkinson, A., Boukacem-Zeghmouri, C., Rodríguez-Bravo, B., Xu, J., Abrizah, A., Świgoń, M., Herman, E. (2017). Early career researchers: scholarly behaviour and the prospect of change. *Learned Publishing*, 30(2), 157-66. DOI: 10.1002/leap.1098

5. Rodríguez-Bravo, B., Nicholas, D., Herman, E., Boukacem-Zeghmouri, C., Watkinson, A., Xu, J., & Świgoń, M. (2017). Peer review: The experience and views of early career researchers. *Learned Publishing*, *30*(4), 269-277. DOI: 10.1002/leap.1111

2018

6. Nicholas, D., Herman, E., Xu, J., Boukacem-Zeghmouri, C., Abrizah, A., Watkinson, A., Świgoń, M., & Rodríguez-Bravo, B. (2018). Early career researchers' quest for reputation in the digital age. *Journal of Scholarly Publishing*, 49/4: 375-396. DOI: 10.3138/jsp.49.4.01

7. Nicholas, D., Watkinson, A., Abrizah, A., Boukacem-Zeghmouri, C., Xu, J., Rodríguez-Bravo, B., Świgoń, M. & Herman, E. (2018), What publishers can take away from the latest early career researcher research. *Learned Publishing*, 31: 249-253. DOI:10.1002/leap.1165

2019

8. Abrizah, A., Shah, N.A.K. & Nicholas, D. (2019) Malaysian early career researchers on the ethics of scholarly publishing. *Malaysian Journal of Library & Information Science*, 24(1), 75-96. DOI:10.22452/mjlis.vol21no1

9. Nicholas, D., Boukacem-Zeghmouri, C., Xu, J., Herman, E., Clark, D., Abrizah, A., Rodríguez-Bravo, B. & Świgoń, M. (2019). Sci-Hub: The new and ultimate disruptor? View from the front. *Learned Publishing*, 32(2), 147-153. DOI: 10.1002/leap.1206

10. Nicholas, D., Watkinson, A., Boukacem-Zeghmouri, C., Rodríguez-Bravo, B., Xu, J., Abrizah, A., Świgoń, M., Clark, D. & Herman, E. (2019). So, are early career researchers the harbingers of change? *Learned Publishing*, *32*(3), 237-247. DOI: 10.1002/leap.1232

11. Nicholas, D., Boukacem-Zeghmouri, C., Abrizah, A., Rodríguez-Bravo, B., Xu, J., Świgoń', M., Watkinson, A., & Herman, E. (2019), Open science from the standpoint of the new wave of researchers: Views from the scholarly frontline. *Information Services & Use*, 39(4), 369-374. DOI: 10.3233/ISU-190069

2020

12. Jamali, H. R., Nicholas, D., Watkinson, A., Abrizah, A., Rodríguez-Bravo, B., Boukacem-Zeghmouri, C., Xu, J. & Świgoń, M. (2020). Early career researchers and their authorship and peer review beliefs and practices: An international study. *Learned Publishing*, 33(2), 142-152. DOI: 10.1002/leap.1283

13. Nicholas, D., Jamali, H.R., Herman, E., Watkinson, A., Abrizah, A., Rodríguez-Bravo, B., Boukacem-Zeghmouri, C., Xu, J., Świgoń, M. & Polezhaeva, T. (2020). A global questionnaire survey of the scholarly communication attitudes and behaviours of early career researchers. *Learned Publishing*, 33(3), 198-211. DOI: 10.1002/leap.1286

14. Nicholas, D., Herman, E., Jamali, H. R., Abrizah, A., Boukacem-Zeghmouri, C., Xu, J., Rodríguez-Bravo, B., Watkinson, A., Polezhaeva, T., & Świgoń, M. (2020). Millennial researchers in a metric-driven scholarly world: An international study. *Research Evaluation*, rvaa004. DOI: 10.1093/reseval/rvaa004

15. Jamali, H.R., Nicholas, D., Herman, E., Boukacem-Zeghmouri, C., Abrizah, A., Rodríguez-Bravo, B., Xu, J., Świgoń', M., Polezhaeva, T. & Watkinson, A. (2020). National comparisons of early career researchers' scholarly communication attitudes and behaviours. *Learned Publishing*, Early View. DOI: 10.1002/leap.1313

16. Nicholas, D., Xu, J., Jamali, H. R., Boukacem-Zeghmouri, C., Watkinson, A., Rodríguez-Bravo, B., Abrizah, A., Polezhaeva, T., Herman, E. & Świgoń, M. (2020). How is open access publishing going down with early career researchers? An international, multi-disciplinary study. *Scientometrics*. Subject to final review.

17. Nicholas, D., Herman, E., Xu, J., Abrizah, A., Boukacem-Zeghmouri, C., Rodríguez-Bravo, B., Watkinson, A., Polezhaeva, T., & Świgoń, M. (2021). Early career researchers and predatory publishing: the views and behaviours of the millennials. *Foresight and STI Governance*, 21(1).

Appendix 3: Bibliography of Products from the Sloan-funded Trust and Authority Project (2012-2013)

1. Abrizah, A., Badawi, F., Zoohorian-Fooladi, N., Nicholas, D., Jamali, H. R., & Norliya, A. K. (2014). What do scholarly channels and resources do authors trust to read, cite and publish in?: A Malaysian study.

2. Abrizah, A., Badawi, F., Zoohorian-Fooladi, N., Nicholas, D., Jamali, H. R., & Norliya, A. K. (2017). Trust and authority in the periphery of world scholarly communication: A Malaysian focus group study. *Malaysian Journal of Library & Information Science*, *20*(2), 67-83.

3. Jamali, H. R., Nicholas, D., Watkinson, A., Herman, E., Tenopir, C., Levine, K., ... & Nichols, F. (2014). How scholars implement trust in their reading, citing and publishing activities: Geographical differences. *Library & information science research*, *36*(3-4), 192-202.

4. Nicholas, D., Clark, D., Jamali, H. R., & Watkinson, A. (2014). Log usage analysis: What it discloses about use, information seeking and trustworthiness. *International journal of knowledge content development and technology*, *4*(1), 23-37.

5. Nicholas, D., Watkinson, A., Volentine, R., Allard, S., Levine, K., Tenopir, C., & Herman, E. (2014). Trust and authority in scholarly communications in the light of the digital transition: Setting the scene for a major study. *Learned Publishing*, *27*(2), 121-134.

6. Nicholas, D. (2015). Using, citing and publishing scholarly content in the digital age: case study of humanities researchers. *Zagadnienia Informacji Naukowej-Studia Informacyjne*, *53*(1 (105)), 7-19.

7. Nicholas, D., Herman, E., Jamali, H., Rodriguez-Bravo, B., Boukacem-Zeghmouri, C., Dobrowolski, T., & Pouchot, S. (2015). New ways of building, showcasing, and measuring scholarly reputation. *Learned Publishing*, *28*(3), 169-183.

8. Nicholas, D., Jamali, H. R., Watkinson, A., Herman, E., Tenopir, C., Volentine, R., ... & Levine, K. (2015). Do younger researchers assess trustworthiness differently when deciding

what to read and cite and where to publish. *International journal of knowledge content development and technology*, *5*(2), 45-63.

9. Nicholas, D., Watkinson, A., Jamali, H. R., Herman, E., Tenopir, C., Volentine, R., ... & Levine, K. (2015). Peer review: Still king in the digital age. *Learned Publishing*, *28*(1), 15-21.

10. Nicholas, D., Xu, J., Xu, L., Su, J., & Watkinson, A. (2016). Chinese researchers, scholarly communication behaviour and trust. *Learned Publishing*, *29*(1), 31-38.

11. Tenopir, C., Nicholas, D., Watkinson, A., Volentine, R., Allard, S., Levine, K., ... & Herman, E. (2013). Trust and authority in scholarly communications in the light of digital transition: final report. *Knoxville, USA: University of Tennessee USA*. http://ciber-research.eu/download/ 20140115-Trust_Final_Report.pdf

12. Tenopir, C. (2014). Trust in reading, citing and publishing. *Information Services & Use*, *34*(1-2), 39-48.

13. Tenopir, C., Levine, K., Allard, S., Christian, L., Volentine, R., Boehm, R., Nichols, F., Nicholas, D., … & Watkinson, A. (2016). Trustworthiness and authority of scholarly information in a digital age: Results of an international questionnaire. *Journal of the Association for Information Science and technology*, *67*(10), 2344-2361.

14. Thornley, C., Watkinson, A., Nicholas, D., Volentine, R., Jamali, H. R., Herman, E., ... & Tenopir, C. (2015). The role of trust and authority in the citation behaviour of researchers. *Information research*.

15. Watkinson, A., Nicholas, D., Thornley, C., Herman, E., Jamali, H. R., Volentine, R., ... & Tenopir, C. (2016). Changes in the digital scholarly environment and issues of trust: An exploratory, qualitative analysis. *Information processing & management*, *52*(3), 446-458.