DEVELOPMENT OF RESEARCH EXCELLENCE: INSIGHTS FROM MODES OF WORK OF HIGH-ACHIEVING EARLY-CAREER RESEARCHERS

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ABSTRACT

When early-career researchers show promise to become the next generation of leading researchers, it is in the best interest of their employers to nurture their careers. This objective requires adequate understanding and support, at both institutional and policy level, of the modes of work of these early-career achievers. Our in-depth, qualitative investigation constructs a rich account of the creative ideation, writing and communication strategies of several high-performing early-career researchers. These researchers, who have already produced a high volume of quality research, are shown to employ modes of work that maintain this output, sometimes in spite of, and not because of, performance-based research-funding incentives and other managerial tools aimed at encouraging quality research output. Our interpretation of these results against the background of relevant empirical and theoretical literature leads us to present findings that we anticipate would be of significant interest to other early-career researchers, as well as to research managers and policymakers.

Keywords: early-career researchers, research output, creative ideation, performance-based research-funding, research management

INTRODUCTION

High-performing early-career researchers (HPECRs) are a valuable human resource for higher education institutions (HEIs). They produce high-quality, creative and innovative research, and they attract performance-based research funding (PBRF) through publication subsidies from the national Department of Higher Education, Science and Technology (previously the Department of Higher Education and Training) in South Africa. For early-career researchers to reach HPECRs' level of research excellence, and to retain talented early-career researchers,

their work-related needs and challenges need to be understood adequately (Pienaar and Bester 2006). Most early-career researchers lack the "currency" of high-quality publications, which accumulates as academic achievements are made (Merton 1968), and which guarantee successful researcher resources (Albert, Davia, and Legazpe 2016).

Factors that affect this publication currency accumulation have been well documented in the literature, but empirical, HPECR-specific insights are lacking for the South African context. South African HEIs would benefit from an understanding of the factors that affect HPECR development. This study was aimed at providing such an understanding, by interviewing eleven NRF "Y-rated" researchers on their personal and interpersonal modes of work against institutional and policy backgrounds, which include the influence of PBRF.

HISTORICAL CONTEXT: SOUTH AFRICAN HEI RESEARCH FUNDING

State support for research at South African HEIs dates back to the 1942 initiation of the Council for Scientific and Industrial Research, where subsidy-based support was an important item on the agenda of its first meeting (Uys 2009). South African HEIs traditionally emphasised teaching over research, until the 1984 introduction of government subsidy linked to research and other outputs (Kahn 2011).

When the apartheid era and international academic boycott ended in the 1990s, South African HEIs began to contend in research-output focused international university rankings (Kahn 2011). Today, the South African National Department of Higher Education, Science and Technology (DHEST) subsidises universities for units of research produced. Each peer-reviewed journal article counts one unit, while book chapters, peer-reviewed conference proceedings and monographs are weighted differently (Weber 2011). The DHEST only allocates subsidy for publications in journals in selected indexes. Journal articles are of importance to this study, as they are the means of primary scientific communication for STEM fields.

At the time of writing, a university would earn an approximately ZAR 100 000 subsidy per unit (Mouton and Valentine 2017), which is allocated according to the proportional contribution of each author affiliated to the respective institutions (DHET 2015). Universities may manage these funds as they see fit. Some institutions – including this study's focus, Stellenbosch University – proportionally allocate subsidy to the faculties who produced the research, and faculty research committees decide on the allocation to the units under their purview (Woodiwiss 2012).

The South African National Research Foundation (NRF) administrates DHEST funding to researchers at South African universities, according to voluntary peer review ratings of

researchers within several predefined categories. The highest NRF rating category is the A-rating (leading international researchers), followed by the B- and C-ratings. Two further rating categories are aimed at the focus of this study, early-career researchers, which the NRF defines as under 35 years of age, and having held a doctorate or equivalent qualification for less than five years when applying. P-rated researchers ("prestigious awards") are considered likely to become international leaders in their fields, based on past research performance and output during doctoral and/or early post-doctoral careers. Y-rated researchers are considered "promising" candidates of 40 years or younger, with potential to become established researchers within five years of assessment (NRF 2016). Each category is divided into subcategories (for example, Y2 and Y1, which will be discussed). Although this rating system is not intended for use as a researcher quality indicator in HEI employment decisions, it is often used as such (Callaghan 2018). In this case, PBRF measures are indeed utilised to gain career advantages, though other PBRF measures may have minimal influence. While other South African PBRF measures are in place, publication subsidy and NRF ratings were more widely encountered among HPECRs than other measures, and were thus most relevant for this study.

REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE

This section reviews theoretical insights and empirical evidence on modes of work that facilitate high-quality, high-volume output (defined primarily as peer-reviewed journal articles), as produced by researchers, regardless of career stage. These factors have been classified as personal, interpersonal, institutional or policy in nature. The results of this study will be discussed against this conceptual framework.

Personal factors

A high intrinsic drive for academic success contributes toward elevated research output in high impact factors journals (Horodnic and Zait 2015). Researchers with high research output spend more than 40 hours at work weekly (Albert et al. 2016). In addition, such researchers have been described as evincing a "sacred spark" – a term coined by Jonathan Cole and Stephen Cole (1973) to refer to the "intrinsic joy that they derive from doing research" (Rogers and Rogers 1999, 473). This drives them to spend significant amounts of time on producing quality research outputs. Researchers who produce a high volume of research outputs have been found to prioritise fast turnaround times and publication productivity efficiency more than the process of making scientific discoveries (Brew et al. 2016). Such researchers focus on using publications as a "currency" that can elevate their professional status in the academic "industry" and, as such, are driven by what Levin and Stephan (1991, 115 refer to as "investment motives".

However, the opposite, that is "consumption motives" centred on "fascination with the research puzzle itself" (Levin and Stephan 1991, 115), also seems to bring about a maintained output of both high volume and quality over time.

Researchers who produce a high volume of research output in journals with high impact factors, welcome journal publisher feedback (Flanigan, Kiewra, and Luo 2018). Successful academic modes of working require a fair amount of independent time management to conduct research, to write and to revise, in what Stinchcombe (as adapted by Whitley 1984, 19), refers to as the "craft" mode of work administration (as opposed to work supervised and scheduled by managers). Whitley (1984) argues that the craft mode applies to academic work, due to its high level of task uncertainty, which limits the effectiveness of preplanning by external managers and leaves the research practitioner in control of tasks, time management and modus operandi.

Researchers who produce a high level of quality research output utilise specific strategies for creative ideation, innovative thinking and problem solving, which also correspond with the craft mode of work. Productive thinking about problem solving, and "Eureka" moments, do not necessarily take place only at the workplace, but also when a researcher is not working purposively on a research question (Simonton 1999), such as during leisure time (Patterson-Hazley and Kiewra 2013). Productive thinking is also more likely to flow from engaging in multiple projects at once, rather than from focusing exclusively on one project (Simonton 1986).

Interpersonal factors

Collaboration in workgroups brings about heightened motivation, mentorship relationships, skills development and actionable deadlines, resulting in increased research output (Brackman et al. 2016). Such increased research output resulting from collaboration is especially prevalent when tacit knowledge and techniques are transmitted between early-career and senior researchers (Lee and Bozeman 2005). One form of such transmission occurs via supervisors mentoring students. This is described as a mutually beneficial form of collaboration, through which the mentee gains access to the mentor's professional networks, experience and expertise, while the mentor gains the mentee's fresh perspectives and ideas (Maluleka, Onyancha, and Ajiferuke 2016).

International collaboration, in particular, is a factor that increases research output (Bergeron et al. 2014), also among South African researchers (Sooryamoorthy 2009; Kahn 2011) as a means to establish an international reputation (Sooryamoorthy and Shrum 2007). Increased research collaboration opportunities, and therefore increased output, has been linked to "citizenship behaviour" of academics within their field, such as serving on journal editorial boards (Bergeron et al. 2014, 118).

A diversity of relatively strong personal connections is needed to ensure that a researcher receives sufficient, non-redundant information from his/her connections to increase research output (Sebestyén and Varga 2013), also when weighted by the journal impact factor (Liu 2015). A researcher's centrality between two unconnected holders of complementary information – a position in a "structural hole" (Liu 2015, 507) – and the ability to bridge the structural hole, strengthens the positive effect of strong interpersonal ties on research output.

Institutional factors

Institutional support high-quality equipment access, work benefits and remuneration are associated with increased research output (Ajegbomogun and Popoola 2013). This is particularly true in middle-income countries, such as South Africa, where a recent researcher brain drain has been linked to experiences of inadequate remuneration (Pienaar and Bester 2006). Unmanageable workloads also significantly diminish job satisfaction among South African researchers (Portnoi 2015). The presence of a strong institutional research culture is also related to increased research output and related citation counts (Barner et al. 2015). Newly employed researchers at institutions with strong research cultures tend to conform to institutional research output norms (Ryazanova and McNamara 2016).

Researchers affiliated to doctorate-granting institutions produce more research outputs than those who are not (Hasselback, Reinstein, and Abdolmohammadi 2012), and an increase in the number of doctoral candidates correlates positively with increased research output (Hariohm, Prakash, and Kumar, 2016). A researcher's role as mentor, teacher and supervisor also has positive externalities, as higher research output is associated with balanced teaching and research workloads (Leisyte 2016). However, administrative load correlates negatively with research output (Albert et al. 2016).

Policy factors

PBRF, or performance-based research-funding, is defined as the ex post evaluation of research by which government funding is allocated (Hicks 2012). PBRF is designed to increase peer-reviewed journal publication outputs through allocating subsidy based on publication numbers (Cattaneo, Meoli, and Signori 2014). In South Africa, PBRF also involves allocating opportunities for resources through peer-review-based NRF ratings. In this case, the intention is to "[reinforce] the importance" of internationally competitive research and to "stimulate competition between researchers", among other priorities. On certain dimensions, it has improved performance dramatically (Mouton et al. 2019) while, on other dimensions, it affects HPECR careers negatively.

PBRF, as commonly happens with purposive social action (Merton 1936), has seen its

effects ramifying to the point that unintended consequences come to partially defeat its founding purpose of increasing quality research outputs. PBRF's system of incentives not only rewards the "currency" of quality research, but also rewards researchers for goal displacement – when researchers focus on "the motives suggested by the indicators rather than the qualities they are supposed to measure" (Weingart 2010, 374). Consequently, they engage in "salami publishing", or cutting research outputs into their smallest publishable units (Weingart 2013, 6), among other forms of goal displacement. South African researchers are also incentivised to publish "least publishable units" in undemanding journals (Vaughan 2008, 93). Thus, PBRF tends to reward investment motives, rather than those who produce quality research (Waitere et al. 2011). It has been argued that this reduction in quality is reflected in basic, mono-disciplinary, low-risk, mainstream, generalist and academic research at the cost of applied, multi-disciplinary and professional research in more specialist journals (Hicks 2012; Weingart 2013). However, positive consequences of PBRF's incentives to publish in high-ranked, international journals include the case of Belgian researchers improving the standards of 21 journals of importance to them to comply with Web of Science (WoS) standards, so as to make them eligible for PBRF rewards (Ossenblok, Engels, and Sivertsen 2005).

Among other negative consequences, a "bandwagon" effect is also described according to which highly cited, "hot" topics and short-term research trends are pursued (Box 2010). In spite of the fact that such work may subsequently be discredited, output and citation credits will remain allocated to the researchers. In the South African context, where the DHEST measures research output every year, a flurry of publishing activity is caused without regard for the contention that "less is better" and that "good research takes time" (Weber 2011, 527).

The journal publication-focused metrics on which PBRF mechanisms often rely are controversial, as they tend not to capture alternative research outputs that are valued in some fields (Dean, Lowry, and Humphreys 2011). In South Africa, PBRF, in the form of DHET subsidies for publication, has been criticised for inadvertently disincentivising collaboration outside of one's university, since such collaboration reduces the subsidy allocated to one's university (Woodiwiss 2012). The NRF's peer-review-based rating system has also been criticised, specifically for its lack of anonymity, bias and power asymmetry (Callaghan 2018), as well as for its inconsistent application across researchers and disciplines (Fedderke 2013).

METHODOLOGY

Research strategy

Contrary to the predominantly quantitative tools used in the measurement of research output, this study required a qualitative, interpretivist research strategy (Schutz 1962) to garner rich

insights on HPECRs creative ideation, and writing and research communication strategies and experiences that lead to their successful production of high-quality work. This approach aided in minimising researchers' reactive responses to being assessed, which often distort research on them (Espeland and Sauder 2007). Rather, participants in the study were provided with a low-pressure and anonymous forum in which to candidly share their frustrations faced and modes of work with the interviewer.

Selection of participants

A group of 11 HPECRs employed at a South African university, Stellenbosch University (SU), were purposefully chosen, primarily due to SU's high ranking in South Africa. SU occupies second place on the CWTS Leiden Ranking of South African universities (Centre for Science and Technology Studies 2017), and selecting a single institution controlled, to some extent, for institutional variability. HPECRs were defined as researchers who have been rated, in the South African NRF rating system, in the Y-category (Y1 or Y2), that is as promising young researchers. The category includes young researchers (defined as 40 years or younger), who have held a doctorate or equivalent qualification for less than five years when applying, and who hold potential to establish themselves as researchers within a five-year period after evaluation. The local and international peer rating of individuals is based primarily on research outputs produced over the past eight years (NRF 2016). The names, titles, specialisations, ratings and institutional affiliations of these researchers were obtained from a publicly available list on the NRF website.

Current as well as past holders of the NRF Y-rating were selected, in order to obtain both current and retrospective perspectives of the researchers' early-career stage. A further selection criterion takes into account variability in terms of field, in that only those researchers in the natural sciences, engineering, technology or medical sciences were selected. These fields have comparable composite scores in Simonton's (2009, 443) ranking of "hard" to "soft" disciplines, which takes into account "citation concentration, early impact rate, peer evaluation consensus, obsolescence rate, graph prominence, consultation rate and the discipline's theories-to-laws ratio".

Data collection

Data were collected using face-to-face, semi-structured interviews, and the interview schedule consisted of open-ended questions. Questions pertaining to preferences around collaboration, modes of work that increased creative idea-generation, modes of work related to planning and writing up research, quality assurance, research communication, journal feedback and

simultaneous projects were asked.

Data processing and analysis

The first author performed the data transcriptions personally, after which participant validation of transcriptions was sought. This resulted in some minor changes made to the transcriptions, predominantly the omission of personal political opinions expressed, and the omission of anonymity-compromising professional details. Thereafter, the data were subjected to several stages of thematic analysis, in order to identify and code common themes in the participants' experiences of the ideation, writing and communication aspects of research production. This process included both open and axial coding stages, as described by Strauss and Corbin (1990).

Ethical considerations

This research was conducted in correspondence with the research ethics requirements of Research Ethics Committee (Humanities) of Stellenbosch University, which provided ethical clearance for the study (Ref No: 7235). In addition to obtaining informed consent from participants, as described above, assurances of confidentiality were maintained by taking comprehensive steps to protect the anonymity of the participants in the reporting of the results, and through secure data management.

RESULTS AND DISCUSSION

Analysis of the data obtained from the participants (Ps) revealed various modes of working and value systems, which influence the ideation, writing and publication strategies of HPECRs. Participants reported employing several strategies in their personal and interpersonal modes of work with students, collaborators, mentors and funders, and encountering facilitating and impeding factors both within their institutions, and under certain policy conditions.

Personal factors

Modes of work undertaken by the individual HPECRs interviewed are discussed in this section, many of which also intersect with other classes of factors, but which focus on the individual HPECR's role in these modes of work. Producing quality, creative research often starts with "knowing your literature" (P3), while personal reflection on discussions at conferences reportedly catalyse the HPECR's thinking on how they "would've done it in a different way" themselves (P6). Exposure to cross-disciplinary ideas provides advantages associated with "borrowing knowledge" and seeing "things from a different perspective" (P3). Reading practitioner-targeted printed media and magazines also catalyses HPECRs' thinking on "what

the underlying causes are" (P7) of certain phenomena. This suggests that HPECRs frequently rely on a mix of multidisciplinary inputs from both applied and academic contexts, which is consistent with Mode 2 knowledge creation (Gibbons et al. 1994, 5).

HPECRs aim to have an "overarching theme" under which these projects fall (P11), and such specialisation is seen to improve one's personal NRF rating (P6). South African researchers have been documented as utilising NRF ratings for promotions and employment (Callaghan 2018), thus providing further incentives for specialisation. This drive towards specialisation is controversial. In a review, Marais (2007) found the NRF rating system to discourage interdisciplinary, Mode 2 knowledge production. HPECRs in this study did emphasise the importance of several smaller foci "on the side" (P9). The phase of "stumbling around and finding your feet" (P6) in the early career provides the HPECA with diverse knowledge and "cool skills" (P8). HPECRs thus find value in the diverse skills learnt during the earlier phases of their career, when they took on "any project" that came their way and "never said no", in order to build an academic career (P6).

Another theme that emerged from the data is the importance of a personal capacity to respond effectively to journal reviewers' feedback, in order to improve the quality of a manuscript. "Emotional" responses to such reports, "because you've invested so much time, effort" in a manuscript (P11), need to be kept in check. According to P9, a more accepting approach to peer reviewers' feedback becomes easier as one's career progresses, and so also one's appreciation that feedback leads to a "better product" (P9). This corresponds to existing accounts of prominent researchers being open to journal feedback (Flanigan et al. 2018).

Interpersonal factors

In this section, the roles that other parties play in HPECR research output production is discussed. Collaborative partnerships and wider networks provide opportunities to "meet people, to learn, to attend conferences and broaden your knowledge" (P9). Collaborators, with which to exchange and "distil" ideas (P5) and spot "holes that you're blind to" over long-term projects (P11), help to "deliver a better product in the end" (P9). HPECRs and multiple collaborators thus engage in Dunbar's "distributed reasoning" (Dunbar 2000, 55) to draw different inductions and conclusions from data, thus aiding creative ideation.

Cross-disciplinary collaboration and discussion can lead to experimentation and serendipitous discovery "out of ignorance" and borrowing methodologies from other fields without "really properly understanding how it even worked" (P8). These collaborations bring about "stupid questions" and "bouncing ideas off each other" that surprisingly lead to creativity through "questioning the paradigm" that one works within (P11). Uninitiated outsiders asking

questions about disciplinary foundations and borrowing methodologies appear to be creatively generative for disciplinary insiders and the outsider, respectively. This conforms to Simonton's Chance Configuration Theory of Creativity, according to which such unconventional patterns of thinking and understanding form creative ideas often by chance, rather than by deliberate construction (Simonton 1988).

Knowledge of the literature relevant to one's own discipline is aided by mentorship relationships. "The avalanche of electronic media", makes knowing "almost everything" there is to know on a topic impossible, and necessitates guidance (P3) from mentors who "know where the gaps are" (P5). This underscores the positive effect of mentorship on production of research outputs, and the quality thereof, through the transmission of tacit skills (Muschallik and Pull 2016). On the other hand, P9 considers "dynamic young people" essential partners in a context of rapid technological change, as senior researchers tend to remain "stuck on the old modus operandi" (P9).

Previous research has shown that academic citizenship behaviours, such as peer reviewing, boosts research output (Bergeron et al., 2014), and our results support this finding. HPECRs reported that peer reviewing offers an inside view of the process whereby the editorial board fields, rejects and accepts articles (P8). This knowledge can then be used "like a review" (P8) to formulate one's own manuscripts appropriately for the target journal. Visibility among peers is also essential to secure collaborative opportunities (P9), which is achieved by HPECRs continuously promoting their research at conferences or workshops, even if it is "the same story two or three times" (P8).

International academic exchanges, that provide HPECRs with the opportunity to collaborate with international peers, allow HPECRs to leave working commitments behind and fully engage in a scientific "tinkering and rummaging" mode of work whilst "constantly talking about" research ideas with international collaborators (P8). P11 and P3 report coming away with "new ideas", especially after visiting "other people's labs" (P3) during international exchanges.

Institutional factors

These factors pertain to roles that institutions play in shaping the work modes of HPECRs, though many of these factors also intersect with other classes of factors. Creative ideation is not limited to working hours at the office, and may happen serendipitously to respondents "on a weekend, hiking in the mountains", when "surfing", "just thinking about stuff" (P1). P11 does not work well within rigid "typical nine to five working hours" and needs the "freedom to explore in a way that works for" him. Similarly, P10 cites academia's relative "freedom to do

whatever" as a reason why he has not accepted a position in industry, in spite of "very strong" financial incentives. This clearly reflects Whitley's (1984) description of academic research as a craft mode of work (as opposed to strictly supervised managerial modes of work).

HPECRs also require an uninterrupted "train of thought" (P7) to capitalise on a productive phase in writing while in "a nice groove" (P6). Finding a spare hour in the working day is "not really enough" (P7) and "blocks of time" (P8) taken "once a week" for "five hours or six hours" (P7) are considered ideal. Working from home allows for this, but is difficult to attain, since there is a "conception" that working from home means one is "not working" (P9). On a more positive note, some respondents referred to the fact that their university allows researchers to work from home at least one day per week, for the purpose of research and writing (P6), or that their department is flexible as regards "working from home" (P11).

Other academic role requirements further limit opportunities for ideation. As P8 explains, "There's just such an unbelievable amount of day-to-day work" with "no way you can think about" anything else during "normal day-to-day work". The office space is reportedly also marred with interruptions, which can result in long work hours, such as "sixteen-hour workdays" that spill over to the home, in order to extend work performance beyond simply doing "one's duties" (P8). Therefore, the results support a previous finding that leading researchers work much longer hours than 40 hours a week (Albert et al. 2016).

Interestingly, and contrary to most other participants, P5 remarked that "90%" of creative ideation happens "within office hours". The reasons are associated with the interpersonal factors discussed in the previous sub-section, as for P5 the office is the space where "one interacts socially with colleagues", and "project planning, advice", "conceptualisation about experiments", as well as feedback on a result with students during office hours, give rise to creative ideation. P4 also referred to aligning the interests of supervised students to bring in "novel ideas" and a "different background" to answer research questions more elegantly. For P9, working with students provides him with "communication lines between a bunch of other people, via the student, leading to me", thereby positioning him in what Liu (2015, 507) refers to as a "structural hole" between complementary information holders.

Also, students can, in P9's words, "explode" HPECR working capacity by picking up "90%" (P5) of laboratory work, allowing the HPECR to be more productive. Similarly, smaller "pieces of the puzzle" (P11) in a researcher's overarching research focus can be allocated to individual students' projects. In this way, postgraduate supervision boosts the production of research outputs and the quality thereof (Leisyte 2016). The relationship between students and HPECRs seems to be a symbiotic one, however, as the HPECR will "give back to the student" (P9) that provides them with, for instance, valuable information. One example of such

reciprocation, mentioned by P4, is the writing of reference letters for students' grant applications. While such administrative tasks may infringe on the production of quality research outputs (Albert et al. 2016), it is also a key component in securing the benefits of supervising excellent students.

In addition to student-related administration, HPECRs tend to carry large administrative burdens associated with securing diverse sources of funding. In particular, the significant amount of time spent on writing funding proposals can, as P10 describes, add "too much pressure" to the HPECRs' workload. The workload associated with securing diverse funding streams is, however, important in diminishing the leverage that individual funders have over research directions, especially industry funders, who might look to halt or hold up research work (P10).

Policy factors

Measures implemented by supra-institutional actors that affect HPECRs' modes of work are discussed in this section. The HPECRs interviewed are aware of the negative externalities of PBRF and new public management in academia more generally, as it alters research behaviour differently across disciplines and may limit academic freedom (Elzinga 2012). For example, scientometric measures, in particular the journal impact factor (JIF), are described by P8 as "just a joke that everyone hates". Nonetheless, it is recognised by P2 that the JIF is "rather important" for "building your career", getting a favourable NRF rating, boosting "the level of credibility you have in the field" and forging collaboration partnerships (P2). This corroborates Callaghan's assertion that South African researchers use NRF ratings to gain career "advantages" (Callaghan 2018, 3).

In response to the importance accorded to JIF by PBRF measures, HPECRs tend to practise "cascading peer review" (Barroga 2013, 90), which involves submitting a manuscript to a journal with a high impact factor first. Such journals have higher rejection rates, but provide "better feedback" with rejection (P9) that can be used to submit an improved, revised manuscript to a journal with a lower JIF. Journal turnaround time for feedback is prioritised, since "time is critical" (P9) in the publication process, as also reported by Wilson (2015).

According to P8, PBRF incentives, if pursued for their own sake, ultimately result in "a lot of nonsense" being published, which in turn "damages" the reputation of the researcher's institution and country. In contrast, the same participant considers intrinsic motivation, being a "perfectionist", being "self-motivated" and "pride in oneself" as the factors that undergird quality publications. Other scholars have also maintained that quality is upheld through intrinsic motivation and professional self-identification, in spite of incentives to simply emphasise

publication quantity over quality (Horodnic and Zait 2015).

PBRF is further critiqued by P8 on the basis that it is biased against fields in which scientific outputs are often artefacts rather than journal articles, and that it encourages bandwagon effects in scientific publishing. As a result, "really difficult, beautiful, detailed stuff" might "never be cited", while "hot topics" that "completely fall apart" and are disproven, retain impressive citation and publication records. The latter tendency of PBRF to incentivise participation in what are usually "passing" research trends, above quality research, is well documented (Box 2010; Northcott and Linacre 2010), in addition to not capturing the full spectrum of meaningful research activity (Dean et al. 2011).

It is therefore concerning that monetary incentives seem to be offered for researchers to publish in journals with high JIFs. One participant mentioned receiving "ZAR 1500 per impact factor", which had been "pretty helpful" (P1). On the other hand, P4 was of the opinion that hunting "for an impact factor" was "dangerous, not good". Another (P8) cautioned that impact factors do not reflect which journals are truly important to a field. Such knowledge, he argues, researchers would gather from reading, reviewing and writing for journals.

CONCLUSION

For the purposes of this study, a sample of South African HPECR participants were awarded the opportunity to elaborate on the strategies they pursued to conduct a high volume of quality research. In the process, the modes of work they utilise, but also the underlying issues they encounter, were elucidated. Intrinsic motivation to succeed in academia is found to inspire HPECRs to produce high quality research publications, rather than, or in some cases in spite of, PBRF.

The HPECRs interviewed achieve their career and research output success through diverse collaborative networks with guidance from mentors, creative ideation among peers, protection of independence from diverse funders and crucial information flows from students. These HPECRs are willing to sacrifice time and effort to complete administrative tasks for students, in order to secure those students that can contribute information and expertise to their research endeavours. PBRF, on the other hand, is shown to have shortcomings as an incentive. These can be understood by applying a craft-mode conception of academic work, according to which even minor managerial measures, such as PBRF, serve very limited purposes and often have unintended consequences. At best, the status that high achievement on PBRF measures brings, is used strategically and pragmatically by scientists for self-promotion and to further secure collaborative networks.

We trust that insights revealed in this study can form a basis for negotiations between

individual early-career researchers, departmental research managers and higher education policymakers. There is a need for increased craft-mode flexibility regarding when, how and where research is conducted, as opposed to mistrust and recourse to accountancy measures associated with new public management (Elzinga 2012), as well as a need to reconsider how PBRF measures may more appropriately incentivise valuable research contributions. Furthermore, increased departmental support in completing administrative tasks may secure stronger interpersonal and funding networks for HPECRs, thereby safeguarding academic freedom for higher education institutions.

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