Career management for early career scientists in developing countries - a South African experience

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Abstract. This paper discusses career development and options for growth for young scientists in developing countries. We also identify and address some of the common challenges early career scientists face, and apply key principles learned from years of research and experience in the South African context as a basis for our discussion. Early career scientists are more likely to succeed in their career if they understand from the start what they need to do in order to grow to the next level and ultimately to the pinnacle of their careers. Strategically, planning one's individual career development is critical to success in the science environment as is the case in any other discipline or domain. The development of early career scientists through their career ladder is determined by a number of factors, many of which are within the control of early career scientists. These factors include qualifications, publication track record, attracting research funding, contribution to student training and staff development, leadership in science, and research impact. The contribution of this basket of measures to development of a career in science is critical for development to certain milestones in one's career. One of the most critical transitions many research scientists have to make is the move from specialist to manager. Expedient promotion of early career scientists to senior management roles without an adequate track record, experience or proper training can be frustrating for both the manager and those under his/her management responsibility. Regardless of the career path one chooses, a solid foundation in research with a good track record of research outputs, funding and the impact of one's research are crucial to one's development along either the researcher career ladder or research management career path.

Keywords: Career development; early career scientists; critical transition; publication; track record; research impact.

Introduction

Increasing evidence suggest that research has a fundamental influence on the development pathway of any country, especially agricultural research (Diao *et al.* 2010). Whilst research culture has been entrenched in many developed countries, research is yet to be fully integrated as part of contributing and addressing technological, economic, societal challenges in most developing countries. One of the approaches to enhance research in the developing countries is through career management of scientists in research positions. In this paper, we highlight career development paths and options for young scientists, with particular reference to the developing countries. Moreover, we identify, discuss, and address some of the common challenges that early career scientists face, whilst illustrating how key principles distilled from years of research and experience in the South African context can offer insights in addressing some of these challenges.

The current consensus is that South Africa is not producing enough scientists with high quality doctoral degrees to meet the development need of the nation. For example, the ASSAf Report (2010) raises concerns about the number of doctorates that South Africa produces per annum (26 per million of total population), which does not compare favourably relative to other emerging and/or developed economies such as Brazil (56), Hungary (105), Poland (159), South Korea (187) at the same stage of development as South Africa or at a stage that South Africa aspires to be. In order to meet some of its developmental challenges, South Africa has identified investment in research and development (R&D) as a major element which would then lead to further upward socioeconomic development (National Planning Commission, 2011). Despite the significance of these targets, the South African basic education system struggles in producing both quality and quantity high school graduates into the university system (Modisaotsile 2012). A study by the Centre for Higher Education Transformation (2009), for example, reported that 2.8 million of 18–24-year-olds (41.6% of the total cohort) were not in education, not employed, and not severely disabled, while of a further 990,000 of this group qualified for further education and training 700,000 were "in the pool" for higher education. This is a result of multiple challenges including: lack of financial resources, poor school education management and the apartheid legacy, amongst others. This state of affairs exerts negative pressure on the student pipeline into the higher education system, which in turn adversely affects the goal of producing the number of quality researchers required, particularly those holding a doctorate qualification which is essential for a scientific career. This highlights a fundamental systemic problem in which the weaker students leaving secondary school place a burden on universities with respect to training these students to become competitive world class graduates suited to

research-oriented careers.

In addition, the few graduates who successfully complete doctoral degrees (<2.5% compared to the candidates who graduate with an undergraduate degree; (ASSAF 2010) and join academic institutions and/or science councils face further challenges in developing their scientific research careers. First, early career scientists have limited time to develop a substantive and meaningful scientific profile, mainly due to high demand for doctoral graduates to manage research in many institutions and to mentor early career scientists. Note this handicap is evident across all research providers in South Africa including universities, science councils, research institutes and foundations. These constraints to development of a research career open the door to the temptation for early career scientists to change streams and take up research management positions as they are offered more rewards than the research career ladder positions.

Secondly, in past years this mixing and shifting of career paths for early career scientists has often had adverse impacts on their options to return to research-oriented positions later in their careers because they lack a track record in technical scientific domains. Another adverse effect is questioning the authority of their science leadership due to a limited scientific research track record based on limited research outputs and publications in peer reviewed journals. Taking into account all these factors, many early career scientists face a dilemma about when to make a meaningful transition from the research career ladder to management of science. That said, the authors acknowledge that, for some scientists, a career in research is a lifetime journey whereas for others, it is used as a stepping stone to other career development goals including management of research.

Critical milestones: career development for scientists

Early career scientists are more likely to succeed in their career if they have an understanding from the start of what are the essential criteria required for them to grow to the next level, and ultimately achieve the pinnacle of their research careers in their chosen discipline (Howard Hughes Medical Institute 2006). From a strategic view point, planning of an individual's career development is critical for success in the science environment as is the case in any other professional discipline or domain, within a supportive, stable and predictable system which is central to supporting research career ladder development. The development of early career scientists through their career ladder is determined by a number of factors, and many of these are within the control of early career scientists (National Academy of Sciences 2009). The factors include: academic qualifications, publication track record, ability to attract research funding by writing innovative project proposals, completing projects on time and within budget, contributing to student training and staff development, develop leadership in science through quality of research and building effective networks, and achieving research impact (based on diverse basket of metrics such as number of citations, h-score factor, and adoption of their work in policies and practices). Essentially, this basket of measures enhances the development of a career as they are indicative of accomplished milestones in one's career.

Taking the researcher career ladder of the South African Council for Scientific and Industrial Research (CSIR) as an example, where each of the five clear rungs is characterized by well-defined milestones as a distinctive discriminator from one rung to the next. The scientific career ladder rungs for scientists at the CSIR are as follows:

(1) Candidate researchers: trainee researchers who work under the supervision of more senior researchers;
(2) Researchers: competent professionals who work independently within a given field;
(3) Senior researchers: seasoned professionals with a track record in R&D, who are able to guide others and lead projects;
(4) Principal researchers: specialists whose sustained track record has led to widespread recognition within their field and who are able to lead a portfolio of R&D projects;
(5) Chief researchers: principal researchers whose sustained track record in several fields of R&D has led to international peer recognition.

Career growth from candidate to chief researcher represents a progression in several dimensions (van Wilgen 2006) such as; transition from following to leading and many other forms of transitions as schematically illustrated in Figure 1.

It should be noted that, although a research career often begins with the completion of a doctoral degree or perhaps a Master's degree in certain cases, qualification alone is often not sufficient and adequate for research career development. Many other traits contribute substantially to career growth including: (1) expert knowledge in a particular domain and/or broad range of domains; (2) demonstrated capabilities as evidenced by published works (*e.g.* scientific journal papers, technical scientific reports, conference articles, books, book chapters, monographs); (3) experience in one's area of expertise combined with specialist skills such as demonstrated by use of specialized programs or software, such as numerical skills and statistics, GIS, modelling; (4) interest in solutions beyond one's domain of expertise as such demonstrating leadership and track record as a strategic thinker grounded in a strong technical base of one's own domain as this provides the

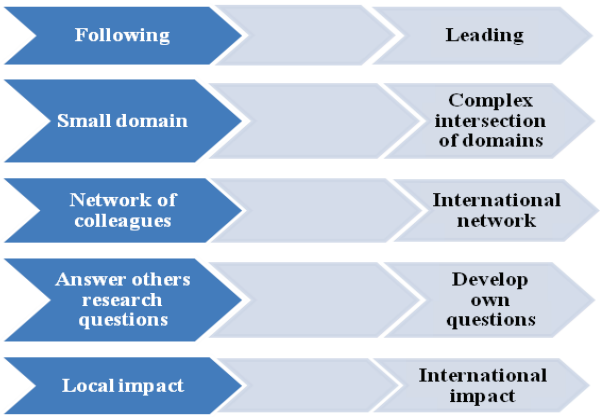

Figure 1. Research career ladder transitions for researchers as a reflection of career growth (adapted from van Wilgen *et al.* 2006).

necessary track record and ability to analyse and synthesise complex issues later on in the career; (5) contribution to human capital development (students and staff development); (6) ability to make sound recommendations to policy-makers based on scientific analysis that results in generating strategic impact; and (7) ability to attract and manage research funding. Because the focus of this paper is on early career scientists, we briefly elaborate on a specific challenge that faces this group of scientists with respect to various career growth options – transition from specialist to manager – and discuss some of the possible options out of this quandary.

Critical transitions: from specialist to manager

Among the key transitions many research scientists experience during their careers is the move from a specialist to manager. One distinctive feature of such transitions is that they often occur in many developing countries including South Africa very early due to the severe skills shortage. Since the number of graduates is limited and the competition for their services is intense, research scientists have substantial pressure placed on them from their organisations to take up responsibilities in the leadership of science. Among the worrying trends in this transition is the expedient promotion of early career scientists to senior management roles without having established a substantive track record or adequate experience. Just as importantly, most research organisations fail to provide proper training or short courses to equip newly appointed research leaders and managers to do their job well. The outcome of such practices is disillusionment and acute frustration for both the new manager and those under their management.

However, early career scientists can carefully plan where they end up in the research career ladder (Figure 2) and can, therefore, avoid the frustrations of leading scientists without the adequate track record required to provide sound leadership of science. A dilemma of whether to continue with research or move towards research management often confronts young scientists, and decisions at this phase can drastically alter careers in science. The biggest questions for any scientist who has aspirations to manage research or lead researchers are: *when* and *how* to make the transition from specialist to manager? The perils of a research career cut short are not obvious at first, but inevitably the switch usually leaves a gap in the supervisory and research capacity of an institution. Leadership of research may also prove to be too challenging for individuals who are not prepared mentally for the switch from research as a day to day occupation to management of research which includes functions such as finance management, human resources management, operations management and many other general responsibilities including development of strategies and stakeholder engagement, tasks that many early career scientists are less prepared to undertake. A good track record in research provides a solid foundation for anyone who aspires to lead scientists.

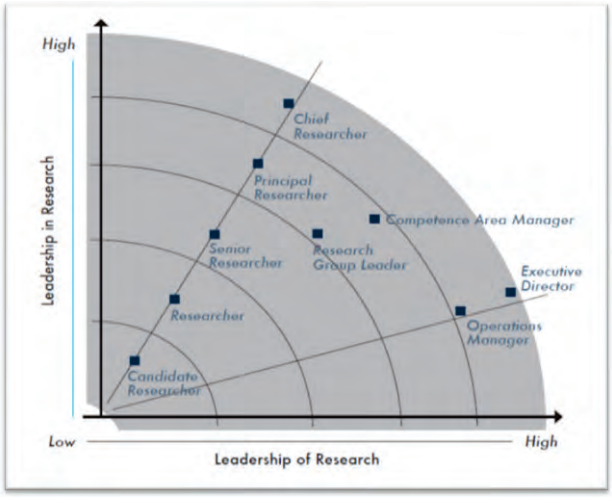

Figure 2. The Research Career Ladder of the CSIR, South Africa (Van Wilgen 2006; used with permission).

Conclusion

A career in science usually begins with the completion of a doctoral or masters' degree in many countries. Although a qualification may show a researcher's potential, the most critical milestones for early career scientists include transitions within the research career ladder that are often determined by research outputs, attracting research funding and the impact of their research. A carefully planned research career is likely to lead to achievement of personal objectives through guiding the development of a clear career path for early career scientists. However, critical decisions about what an early career scientist would like to do later in life are important in determining one's career development. In particular, these include when and how to switch from specialist (research career ladder) to management of research. Regardless of the career path one chooses, a solid foundation in research with a good track record of research outputs, funding and the impact of one's research remains crucial to one's development along either the researcher career ladder or research management career path. The dilemma of these shifts or transitions does not only affect individual scientists, but also affects research organizations in many developing countries who contend with hard questions about how long should scientists stay in research before they switch to management of research. This has many implications including research capacity and capacity for human capital development and also has implications for strategic leadership of research and development.

References

Academy of Sciences of South Africa (ASSAf) (2010) The PhD Study: An evidence-based study on how to meet the demands for high-level skills in an emerging economy. Consensus Report, Academy of Sciences of South Africa. 153 p. Downloaded June 3, 2013. http://www.assaf.co.za/wp-content/uploads/2010/10/40696-Boldesign-PHD-small-optimised.pdf

Centre for Higher Education (CHE) (2009). *The State of Higher Education.* http://www.che.org.za/documents/d000201/ Accessed 3 June 2013

Diao Xinshen, Hazell P, Thurlow J (2010) The Role of Agriculture in African Development. *World Development* **38**, 1375–1383

Howard Hughes Medical Institute (2006) Making the Right Moves. A Practical Guide to Scientific Management for Postdocs and New Faculty.

Modisaotsile BM (2012) The Failing Standard of Basic Education in South Africa. Africa Institute of South Africa 72 – March 2012, pp. 1-7

National Academy of Sciences (2009) 'On Being a Scientist.' National Academy of Sciences Press.

National Planning Commission (2011) National Development Plan: Vision 2030. Department in the Presidency, Government of the Republic of South Africa.

Van Wilgen B (2006) CSIR Guide to a Career in Research. Unpublished Report.