

SCIENTIFIC EXCELLENCE AND RESEARCH OUTCOME-BASED ASSESSMENT APPROACHES

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Introduction

Recent advances in rapidly developing science and technology, especially key discoveries in biomedical research have the potential to significantly improve human health quality and overcome many health challenges in the world. As a result, many countries, including developing countries are increasing the resources dedicated to establishing centers of excellence and innovative technology clusters. A world-class research enterprise to conduct cutting-edge biomedical research in this century must establish a comprehensive system to attract, retain and develop talented researchers from both local and international scientific communities. Furthermore, strong mentorship for junior researchers and students must be an integral component in these centers.

The Nazarbayev University of Kazakhstan aims to become a globally recognized teaching and research institution so that its students are equipped to compete internationally. Academic freedom and institutional independence are legally sanctioned at Nazarbayev University, setting it apart from some other universities in Central Asia. In the past two years in Kazakhstan funding allocated to science and research has more than doubled in accordance with the Ministry of Education and Science reports. Kazakhstan's healthcare spending has been experiencing steady growth for past few years as well. Upgrading the existing system, improving mechanisms for implementation and increasing efficiency and effectiveness of professionals working in health services as well as increasing quality of medical services provided, remain to be the priority area for development. Total financing of science grew almost 2.5-fold over the last two years.

The Ministry of Education and Science (MES) has been focusing on the importance of financing of scientific research through financing of educational institutions. More investment means more funding is allocated to the development of infrastructure, equipment and quality of research. Innovation can be nurtured through adequate investment into not only development of infrastructure but also through cultivation of young talent through education. More funding is needed to educate promising young scientists and scholars leading research centers and institutes. Kazakhstan has seen growth in numbers of young scholars and scientists emerging in the region.

Younger generation is showing increased interest in science majors across the country as more and more universities offer scientific majors. The Ministry identified many challenges that lay ahead, which include the need for technological modernization of the scientific infrastructure, synchronization of science with innovative development and encouraging cooperation between science and business. In order to streamline this process the Ministry has formed a "Science Fund" with 21 scientific projects in Kazakhstan that are aimed at practical solutions to streamline research. In Kazakhstan, it is of outmost importance to prevent losing qualified scientists and researchers to other countries. Kazakhstan's government recognizes this issue and encourages cultivating and nourishing home grown talent by providing adequate investment into development of first and foremost, educational institutions, infrastructure, teaching staff and equipment. Innovation comes with invention, and invention requires substantial investment, this is the reality that the government has taken notice of.

Current activities to promote research excellence

The Nazarbayev University Center for Life Sciences was registered in December, 2010, as an independent entity owned by the University and became fully operational since June 2011. The Center's vision is to develop fundamental and obtain new knowledge about the nature and behavior of living organisms and to use this knowledge to extend quality of life and improve the health of the population in Kazakhstan. The mission of the Center is to be a Leader in the transformation of medicine in Kazakhstan by carrying out innovative research and translating research results into practice. The Center is focusing on high-level training of medical scientists so that they can engage with and contribute to the international medical research community.

The Center is embracing the principles of evidence-based medicine and encourages its practice. The Center for Life Sciences is a part of an integrated academic health-care system that includes six medical centers of the National Medical Holding, a School of Medicine as well as future Oncology Center. These centers provide care in obstetrics and gynecology, neurosurgery, diagnostics, cardiology and cardiac surgery, emergency care, and pediatric rehabilitation. As part of this system, the Center for Life Sciences integrates scientific research programs with clinical practice and education. In 2015, a school of medicine will be added to Nazarbayev University, and will be integrated into this system. A challenge facing the Center for Life Sciences is to raise the quality of biomedical research in Kazakhstan to international standards given budgetary constraints. One way in which the Center is tackling this challenge is to develop partnerships with leading academic centers internationally and to seek advice and input from leaders in this field. Such partnerships were established with centers such as the University of Pittsburgh, Duke University, Columbia University, NIH, Seoul National University, BGI, Oxford University, Cardiff University, University of Brighton, UCL, RIKEN Center for Genomic Medicine, Yokohama, Japan, Kyoto University, National Cancer Center of Tokyo. Center for Life Science researchers have spent time in various training and joint programs at these centers. In 2011 for the first time in Kazakhstan the International Partner Advisory Board was convened.

The International Partner Advisory Board was established as an acting body of Center for Life Sciences, which oversees ongoing research activities of the center in the field of personalized medicine, genomics and multi-omics research, bioinformatics, global health, pharmacogenomics and has been following the progress and development of number of its projects. The mandate of International Partner's Advisory Board is to provide guidance and support initiatives proposed by CLS research scientists. Board members were interested and engaged in discussions regarding the Center's strategy and research programs. The Board provided constructive advice on specific research projects and supported the strategic directions of the Center for Life Sciences. CLS scientists have an excellent opportunity to not only gain significant expertise and experience, but also to perfect their knowledge through collaborative research projects outlines in research initiatives. Advisory Board concurs that in order to maintain the quality of research conducted at CLS, it is vital to develop adequate infrastructure and provide intensive training to research personnel and abundant investment is necessary for further progress. Advisory Board is committed to aiding CLS in achieving its research objectives and anticipates that the ultimate outcome of this research will make valuable contributions to development of various fields of biomedicine in Kazakhstan and beyond.

The challenge faced by current biomedical researchers is the difficulty in bringing together a collaborative multidisciplinary research team which should include distinguished researchers, experienced practitioners and highly skilled industry personnel in order - to yield significant research outcomes. Indeed, funders of any research are increasingly seeking, more outcome-based indicators of societal and economic impact as they evaluate the value of the research. For example, in the United Kingdom, the Higher Education Funding Council for England (HEFCE) developed proposals for the Research Excellence Framework (REF) to allocate public research funding to higher education institutions, inter alia, on the basis of the social and economic impact of their research. Twenty impact indicators from seven categories proposed by HEFCE are presented; their strengths and limitations are discussed using insights from the relevant biomedical and research policy literature. It was confirmed that that the majority of the proposed indicators have some validity, there are significant challenges in operationalizing and measuring these indicators reliably, as well as in comparing evidence of research impact across different cases in a standardized manner. It is suggested that the public funding agencies, medical research charities, universities, and the wider medical research community work together to develop more robust methodologies for capturing and describing impact, including more valid and reliable impact indicators. It is quite common for the h-index and the impact factor to be used as the objective measure of research impact. At the same time in December 2012 the San Francisco Declaration on Research Assessment (DORA) was initiated by the American Society for Cell Biology (ASCB) together with a group of editors and publishers of scholarly journals, recognizes the need to improve the ways in which the outputs of scientific research are evaluated. It was noted that it is a worldwide initiative covering all scholarly disciplines and they encouraged individuals and organizations who are concerned about the appropriate assessment of scientific research to sign DORA. As Steen (2013) points out, *"the San Francisco Declaration on Research Assessment (DORA) criticizes Journal Impact Factor (JIF) without offering an alternative"*.

Conclusion

The potential benefits and limitations of bibliometrics in the evaluation of research, as well as the relationship between metrics and peer review, databases used as sources of bibliometric analysis should be assessed with caution and in the context of all indicators of scientific impact. It should be noted as well that the fundamental format of scientific exchange and publishing, assimilation of scientific information, and teaching pedagogy have not changed in a century. In the 21st century our internet-supported culture resulted in rapid access to poorly validated information. The pivot of knowledge is still considered the peer-review process, but it is limited and not measurable. This process does not provide for an intensive interaction between the reviewer-author-editor-end user which would be more efficient and quantitative.

To overcome these challenges we have to consider possibly university-industry-public-governmental partnerships in Kazakhstan who will be: 1) involved in promoting excellence in science and fostering research outcomes translation; 2) establishing industrial cooperation and partnerships; 3) properly analyzing and addressing important societal challenges; and 4) promoting research competitiveness and an appropriate business/innovation environment. These issues are of critical importance and a solution is urgently needed to be effectively solved in a timely manner. In this century an evaluation methodology using informative indicators should be developed to assess research performance across four broad categories:

innovations and knowledge creation; intellectual and highly skilled potential development; research policy improvement and significant return on research investment; and industrial and public outcomes.

The new methodology should be responsive to the requirements and needs of all parties involved in conducting and supporting research. This would be an ideal methodology in the field of evaluative bibliometrics, a subfield of quantitative science and technology studies. It might also be a powerful tool for evaluating institutional research advancements, proficiency in science, and a key driver for scientific excellence in biomedical research.

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