



Global Research- Sequestration and revisiting the legacy

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ABSTRACT

Global challenges need global solutions. With dwindling funding options and resources, it has become imperative that reasons are found for research funding drainage and solutions are proposed for sustainable research initiatives. Repetitive research in isolation, more focus on basic research, limitations of applied research initiatives and bureaucratic hurdles are major impediments to sustained research funding. Overcoming such barriers involves developing a global research council, proactive principles and policies, sharing research output, common policies for collection and distribution of big data for analysis, greater mobility of researchers and long-term commitments. Collaboration and dissolving boundaries is also a long-term solution for sustainable research. Several alternatives have been proposed to reduce funding for repetitive research initiatives or sharing objectives.

Keywords: Science research, funding drainage, collaboration, repetitive research

INTRODUCTION

Research initiatives are the backbone of any University and academic institution. Good quality publications and prestigious laboratories with high-end-facilities and research projects with huge funding add to the prestige of the University. The global investment in research and development annually is US \$1.4 trillion. Investment in biomedical research alone has an annual estimate of around \$240 million (5). However, sequestration in research, mainly science research has become a major problem forcing a re-look at the way funds are decided, allocated, utilized and the findings reported. In 2013 alone, NIH was forced to cut \$1.7 billion from its budget (2). An article in Huffington Post talks of sequestration as the dark age for science research in America and discusses the plight of several scientists who till recently had funding of millions of dollars and now struggle for continuation of their promising research. Other highly relevant issues like a significant

number of the research projects contribute nothing or very little to knowledge, practice or policy also need serious consideration. The research we need is much less in terms of the real output we are getting now. Irreproducibility and waste in research has become a major issue that is rendering presently conducted and reported research misfit to be cited and used in future. The framework for research needs an overhaul so that it is done in a better way, done for the right reasons and documented for better use by future researchers (1, 2, 3, 4).

Another aspect that needs serious consideration is that the rejection rate of publication in the most prestigious journals is over 90%. Most striking findings have the greatest chance of getting accepted and published. The pressure on scientists to report their findings in the 'best' journals in order to increase their market value and prestige is enormous. This forces scientists to prune insignificant /inconvenient data and negative findings so that the research output looks more appealing and acceptable in the research arena. These results are mostly irreproducible when replicated and contribute to further drainage of resources. The validity of information on the Internet and in journals is questionable and often found wrong or misleading with no substantiating evidence or past references. There is also an honest confusion between a genuine discovery and statistical noise. Failure to prove a hypothesis is rarely offered publication. Negative results are only 14% of the published papers. Researchers waste money and efforts exploring alleys already investigated by researchers. The level of irreproducibility and doubtful reporting has become a serious issue and needs to be addressed for economic reasons and in terms of real contribution to science. The article details a study made to find out the deficiencies in research decisions, design, regulation and reporting and attempts to suggest solutions for overcoming the crisis [20, 21].

Sequestration and wastage- where have current research trends gone wrong?

Research funding drainage is a serious issue. Major funding agencies are forced to make necessary cuts with lesser funds to offer. Similar cuts are also being made by the government agencies in their research budgets. The universities are diverting funds from better-funded projects to not-so-lucky ones to help them survive the crisis. The length of some of the projects has been shortened and others totally eliminated. These have mostly been economic decisions. A more serious look at how we conduct research today is needed to rethink how the sequestration can be managed. The issues that have escalated the situation we are in today are also the following:

1. Repetitive research in isolation
2. More focus on basic research
3. Problems with applied research
4. Bureaucratic routes for products to reach the market

5. Research replication and irreproducibility

If we take the example of laboratories working on any disease across the world, there is no conglomerate for them to share their finding other than in a few conferences where they find limited common ground. It will greatly help and save funds if such conglomerates are formed to share objectives, avoid repetitive work and share results. This way huge funding drainage into repetitive objectives and inaccessible results can be saved. There will also be better research output and speedier solutions for societal problems.

Relative investment in basic and applied research is also under scrutiny. Half of the investment in research in UK and US goes to basic research. It is also reported that most clinical research stemmed from basic research (6, 7, 8). However, basic research is not valued highly as most initially promising findings with future application appear to be false positive and exaggerated. The time needed for translation of basic research is generally long with estimates between 10-20 years (9). This also calls for exhaustive investment in applied research that may not lead to any positive outcome after such a long period and hence, is wasted. However, efforts are being made to minimize time for application of research based on the design of the experiments and trials. The funding for applied research is also picking up with the hope for quicker solutions for the future in the 'bench to bedside' format. There has also been a huge disconnect between what basic research can do and what users of research really want which needs to be addressed at the earliest.

There is also a huge time lapse between when a product is ready to hit the market and when it actually does. The process of approval by government and the regulatory bodies is extremely tedious that results in waste of valuable time, money and manpower in addition to depriving the public of its benefits. Regulatory processes, government approval and ethical clearances have become extremely burdensome and time consuming. These are projected to be in the interest of safe research and for protection of subjects but they are exceedingly inconsistent and vary resulting in inefficient management and wastage of precious time and funds with huge inconvenience to individuals involved.

What separates science from a mere anecdote is the element of reproducibility (12). Basic research does not provide a sufficiently reliable basis for areas like drug development (10). Out of 53 significant reports of basic research on cancer, Amgen, a private company, has not been able to replicate 47 of them. This problem has also been reported by a large number of other pharmaceutical firms who have tried to pick up promising findings and work further on them to develop drugs for the future. It has not been possible to reproduce what has been reported in most of the cases. Obtaining funding for replication what is already reported is always a huge struggle. However, validating the initial results is a must before experimenting further (11). Journal PLOS ONE has announced a policy of submitting relevant data as part of the review process [19] in order to check reproducibility. Russell *et.al.* suggest that funding agencies should tie grant funding to replication (12). If research cannot be replicated, it should be retracted or

amended. These aspects have limitations, as it would slow the dissemination of novel research. Replication studies are hard and publishing amendments may take a very long time. It would also discourage high risk, high reward science which is less likely to be reproducible. However, addressing the problem of irreproducibility also requires immediate attention.

Research parameters under scrutiny

The investment in research in terms of funding, experimentation, regulation and reporting of science research has come under serious scrutiny as the way a research initiative is carried out like application for funding, selection, sanction, conduct and reporting needs a relook. The aspects under scrutiny are the following:

1. Research decisions based on questions relevant to users of research
2. Research design, methodology and analytical interpretations
3. Regulation and management of scientific research
4. Reporting of research as unbiased, reproducible and usable

Hence, almost every aspect of the way science research needs overhaul to overcome present crisis faced by science funding. An investigation into publications of highly cited journals indicates that there has rarely been a systematic review of the previous work before undertaking clinical trials (16). In fact, many scientists were not even aware of the evidence that already existed for research and trials conducted in that area (14). Only four out of 446 clinical protocols studied by British research ethics committees had planned their target trials based on exhaustive study of previous data available in the field (14). Ignoring or not putting considerable efforts into finding out what is already known is a serious lapse and is difficult to defend scientifically and ethically. It is also economically draining, as rather than addressing lapses in previous study and working on the promising aspects; the same study may have been replicated with the same deficiencies and reported again in a different form. Such a huge drain on precious resources is highly unacceptable and leads to huge wastage. Without a systematic review, the animal experiments are sometimes unnecessarily replicated. This could have been easily avoided and animals saved for other more relevant projects. If the studies are about drugs with toxic effects or have life threatening side effects, it could lead to unnecessary deaths. Also, if the previous study on any drug has shown no effect, then unnecessary enrolment of subjects into clinical trials could also have been avoided. An enrolment of 7000 stroke patients in a clinical study of nimodipine could have been avoided if systematic review of previous studies had been done, as the drug was already found to offer no protection (15).

Another reason for wasted funding is selecting only those studies that favor your research and promise desired results. Conveniently pruning those findings which will put your research to doubt, selecting and reporting only those which enhance the significance of the research undertaken misleads the reader into believing something that is mis-reported. Several standard reporting guidelines like CONSORT, STARD, PRISMA, ARRIVE etc.

have been issued by prestigious publishing groups that ensure adequate reporting and set standards for future publications. There is also a move to make detailed protocols publicly available so that the exhaustive process of writing of protocols is not repeated and standard protocols are available (17,18).

Possible solutions for sustainable research initiatives

Several solutions are being proposed that may already be in practice in isolation, but need consistent application. The aspect of collaboration has become increasingly relevant and the need of the hour. Laboratories handling similar research objectives and those working in the same area need to form conglomerates and brainstorm to share objectives, adopt an interdisciplinary approach and share data, so that repetitive research funding can be controlled. This will also facilitate siphoning precious funds to address other promising areas of research that may be bearing the brunt of sequestration.

The process of collaboration may require certain adjustments including understanding each other's motivation, be willing to drop features to ensure completion, be willing to keep contributions modular to reduce failure risk, be prepared for agreements to go wrong and have fire-fighting mechanisms. Working as a team across the globe with clearly defined objectives and dispute resolution mechanisms, has become the need of the hour. Collaborative efforts should also focus on academic-industry interaction so that the 'bench to bedside' vision becomes a success. Industry partnership also ensures initiating a research project as a business model and developing it into a ready venture. It has also become imperative to make research findings public and open so that repetitive research can be avoided and future scientists can do a systematic review of the past research before planning future research objectives and deciding on judicious utilization of funds.

Policy decisions that may favor sustainable research

Several decisions may be required at the policy level that may make a significant difference to the current problems encountered in the research arena. These include:

- Implementation of an International/National strategy
- Integration of research facilities within the structure of decision making policies
- Restructuring of scientific research matrix
- Search for unconventional funding
- Training Personnel
- Taking steps to enhance innovation
- Boosting IT and quality control

Global Research Council needs to take up the task of forming an international strategy of judicious utilization of available resources that is implementable across the world, by suggesting a strategic plan to control sequestration. It is also important that national strategies be made, defining the priority areas of that country/academic establishment according to social needs and relevance for that area. Public dissemination of the national strategy will ensure better compliance and implementation. Integration of research facilities within the societal decision making policies has become imperative in the interest of making research relevant to the needs of the society. This would ensure setting aside essential resources for developing these facilities. An area that needs careful planning and implementation is restructuring of research matrix. Universities are the centers of research that also need to become consultants in areas of expertise. It is also important to have finances specially dedicated to Central Instrumentation facilities so that repetitive purchases in individual laboratories can be avoided and equipment lying defunct in isolated laboratories is put to good use. Establishing distinguished research centers, developing standards of excellence, forming specialized interdisciplinary research teams and encouraging real partnerships and collaborations has become the need of the hour. Searching for unconventional sources of funding and ensuring cooperation between public and private sectors in the domain of research funding, with clearly defined responsibilities and rights will be able to manage repeated or denied funding. It is also imperative to train personnel for competitive handling of research projects and ensuring better research management. Developing creativity-enhancing curricula, rewarding promising innovative ideas and developing academic research ethics code are some of the steps that can be taken for enhancing research innovation. Digital literacy and integrating technology in research is a necessity for surviving in the ocean of information that has a lot to offer but needs to be managed selectively. These policy decisions will go a long way in ensuring better research management and avoiding any future shocks related to sequestration that is ushering us into a dark age for science research.

Overcoming current barriers to sustainable research initiatives

The need to overhaul how research is funded, planned, conducted and reported today, requires systematic decision-making involving the government, policy makers, researchers, future researchers, representatives from society and users of research. This study conducted at all levels of research management, suggests the following measures to overcome the barriers to sustainable research initiatives:

- a) Redefined research policies
- b) Global review and research integrity policies
- c) Global Research Council
- d) Shared resources/ Research output /Open initiatives

- e) Long term commitments
- f) Policies for collection, analysis and distribution of big data
- g) Greater mobility of researchers
- h) Research as a business plan/ Work in collaboration with industry
- i) Patent free research
- j) Check on repetitive funding
- k) Check on irreproducible research
- l) Start young

There is a dire need to have a re-look at research policies, as the best interest in managing all aspects of research needs an overhaul in the current scenario. The process of peer review and policy of research integrity also need to be more stringent and well defined in the interest of researchers. Global Research Council with membership of all nations across the world must ensure uniform implementation of well-defined policies in the interest of sustenance of research across the world.

Sharing research facilities and findings with fellow scientists, and bringing them out of close circles is something the world cannot do without now. In order to beat the blues of sequestration, sharing is the only required strategy that can be the answer for an end to sequestration. A systematic review of previous study and methods to prevent under reporting of research must be made imperative to avoid wastage of resources in conducting similar studies in isolation and effective replication of already conducted research. Keeping the research in open access and developing conglomerates to share findings will speed research output and save valuable resources. Several such initiatives have successfully been implemented in the past like the human genome project and some sequencing initiatives of some other genomes. An aspect that may need careful consideration in some research projects while defining the objectives would be regional consideration of the problem being researched which may be taken up additionally for more promising local application in future.

There is huge amount of data on the Internet in open or under guard catering to specific criteria. Hence, the same data is repeated manifolds in different forms. There is an urgent need to form a policy for managing, aggregating and checking the quality of data put on the web and monitor its repetition. The policy should also ensure that the data is out of the closed circles and easily accessible to the researchers to avoid duplication and waste. Collaboration has been suggested as a possible solution to share resources and enhance productivity. Hence, mobility of researchers should be encouraged in interest of enhanced output and better management of resources.

Patenting adds to the value of a researcher, and is recognition of the work quality and research repertoire. However, filing patents restricts the use of the information and

prolongs the time when a research comes into public domain. This results in denying immediate benefits to the society and other researchers who can build on the new information to provide new solutions and build on the innovation. An environment of patent free research may greatly reduce waste and benefit the society in the long run. The measure of quality of research conducted and the evaluation of a researcher may be based on other parameters including their contribution to real world problems of the society and efforts to reduce waste. The measures required for checking repetitive funding and irreproducible research have already been detailed previously, but remain a major reason for research funding drainage and needs immediate attention. And lastly, it is also important to inculcate creative and analytical thinking in young minds while exposing them to real world problems. Their potential to come up with innovative solutions with a fresh approach, which is restricted by minds trained to think in a particular way, will be extremely beneficial to the society in the long run, when such ideas are implemented to find solutions to challenges of the society.

CONCLUSION

Several aspects that ail the global research initiatives; especially science research were discussed. These cause wastage of valuable resources and make it either repetitive or irreproducible. If these issues are adequately addressed, most of the problems that sustainable research is facing today can be managed for better efficiency and output. The wastage in research due to not aligning basic research to the needs of the user, inadequate reporting of research and defective regulatory processes has led to huge economic losses. These funds could have been siphoned to address numerous more relevant questions. These require urgent attention and must be addressed to overcome funding deficits. The solutions offered at the level of government, policy makers, funders, researchers, users of research and future researchers, if implemented, will help overcome most of the problems faced today by researchers.

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