# Return on Investment and Grants: A Review of Present Understandings and Recommendations for Change

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## ABSTRACT

The need to understand efficacy and outcomes from grant-funded activity is common to funders, the academic community, and the public. Yet, few articles in the research administration corpus offer details on and considerations of applying the concept of return on investment (ROI) to grant activity. To determine the volume of material available aside from publications specific to research administration that considers systematic assessment of ROI for grants, a review was undertaken of the periodic literature available on the ProQuest database. A Boolean search for "grant" AND "return on investment" produced over 2,700 results. Following review, 34 of these sources were found to be relevant to a discussion of the systematic application of ROI to grant activity. These articles make it clear that interest in ROI for grants is not isolated to a few disciplines or areas of professional practice and that two categories of use are common for ROI with respect to grants: "econometric calculation" (Frank & Nason, 2009, p. 528) and "impact of…activities" (Weiss, 2007, p. 206). A second substantial theme in the literature is the misalignment of fiscal return on investment and assessment of grant-supported projects. Establishing assessment patterns that consider benefits derived is a preferable pattern. While government agencies in a number of countries have initiated processes of this type, their foci will not facilitate local, institution-specific benefit analysis. Two patterns for measuring and assessing impacts of grant-funded activity are recommended: Uttam and Venugopal's "assessment of benefits from sponsored research" (2008, p. 57) (developed for the Indian National Chemical Laboratory) and the rubric-based, balanced scorecard approach commonly employed in business settings.

## RATIONALE

The desire to understand the efficacy and outcome of an investment is both common and wise. The need for such understanding extends to grant-funded activity for all stakeholder categories and especially for the funder, the research community, and the public (Weiss, 2007).

Prior to his work on this study, the author knew of only two publications on the systematic application of *return on investment* (ROI) to grant activity. This understanding was formed during a research administration literature review on the measurement of grant capacity and readiness (Preuss, 2015). In an effort to determine whether sources addressing assessment of the ROI of grants existed in the general scholarly literature, a review was undertaken of the periodic literature available on the ProQuest database.

## PURPOSE

The literature review was designed to answer three questions:

- How has the concept *return on investment* been applied in periodic literature with respect to grant-funded activity?
- Is there a consensus regarding whether and how this construct should be applied?
- Have systems been developed for the application of this principle to grant-funded projects?

In addressing these questions, the researcher considered all digitally accessible sources on the ProQuest database through June 2015.

## DEFINITIONS

Return on investment (ROI) is a financial measure that has long been employed in the business world to monitor performance (Wheelen & Hunter, 2004). It is a simple calculation. "To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio" (Investopedia, 2015, para. 1). Mansfield's 1991 study of research is a pertinent example—he calculated the annual rate of return for academic research to be 28%, a figure current authors have called into question (McIlwain, 2010, p. 683; Mansfield, 1991).

The second key concept in the literature review, grant-funded activity, was defined as an undertaking for which a scope of work, timeline, and performance objectives have been defined and a sum of money has been provided by a third party for expenditure only on a particular undertaking by an individual or organization.

## METHOD

A modification of the PRISMA pattern for systematic review (Moher et al.., 2009) was employed in developing the investigative method and as a guide in reporting. The PRISMA pattern consists of "a 27-item checklist…and a four-phase flow diagram" (Liberati et al.., 2009, para. 6), detailing the *P*referred *R*eporting *I*tems for *S*ystematic reviews and *M*eta-*A*nalyses. This pattern originated as an approach to reporting on literature reviews in the health sciences and is described in the following way by its creators:

> A systematic review attempts to collate all empirical evidence that fits pre-specified eligibility criteria to answer a specific research question. It uses explicit, systematic methods that are selected to minimize bias, thus providing reliable findings from which conclusions can be drawn and decisions made (Liberati et al., 2009, para. 3).

The review was conducted between late 2014 and early summer 2015, beginning with consideration of every source available on the ProQuest database containing the word "grant" and the phrase "return on investment."

## DATA SOURCES AND SELECTION

ProQuest classifies sources within publication categories. A Boolean search of "grant" AND "return on investment" produced over 2,700 results. The listing of publication dates had a natural break at the year 2000. Only one potentially relevant source had been published between 1980 and 1989. A total of 101 articles published in the 1990s contained the word "grant" and the phrase "return on investment", with a total of 35 between 1990 and 1996, 16 in 1997, 24 in 1998, and 26 in 1999. However, 58 articles published in the year 2000 contained both terms, with a rapidly increasing number each year from that point onward. The researcher elected to include only articles from 2000 to 2015 in order to pare down the number of possible sources, to respect the point at which interest in the topic seemed to catch hold and accelerate, and to place the consideration in a fairly recent context. Between January 2000 and June 2015, 2,479 documents were listed across the eight types of publications available on ProQuest. In descending order, 1,223 scholarly articles, 435 dissertations or theses, 358 trade journal articles, 256 reports, 201 newspaper articles, 3 conference proceedings, 2 working papers, and 1 publication not otherwise classified were identified. Of these, newspaper articles were excluded from consideration. This decision was taken because newspapers are popular media

rather than scholarly media and therefore highly unlikely to report professional understandings of the application of ROI to grants or to describe systems intended to analyze grant activity ROI. The titles and abstracts for the remaining 2,278 potential sources were read as a means of identifying articles relevant to the topic.

An article was classified as a potentially relevant source if it appeared to apply the concept *return on investment* to an individual grant project, to grants in general, or as part of a systematic consideration of grant activity. Examples of terms considered indicative of this type of content included: *assessing*, *measuring*, *evaluating*, *calculating*, *factors*, *variables*, *return on investment*, *ROI*, *grant*, *foundation funding*, *government funding*, and *external funding*. If an abstract was not present, as is frequently the case with material published in trade journals, the initial pages of the piece were read to identify the article's purpose. The judgments regarding the relevance of each article to the purpose of this review were made by one researcher. All source decisions were made by the same researcher, eliminating potential for inter-reviewer bias.

The number of articles considered as possible sources, arranged by the classification system employed in ProQuest, the number of those from each category initially thought to be relevant to the investigation, and the number ultimately judged to be applicable are presented in Table 1.

More sources were thought to be relevant in the initial culling than actually proved to be applicable. The most frequent cause of this was the use of the term *grant* exclusively as a verb rather than as a noun. Authors of works considering the concept *return on investment* often used the word *grant* to communicate *giving, allowing, admitting, permitting, conceding*, and other possible synonyms, rather than employing the term to refer to externally-funded projects, as in the present review. There were also whole categories of potential source material that yielded no relevant sources. None of the potential sources from the reports, conference proceedings, working papers, or "other" category proved to be applicable to the purpose of this review. A common reason for the elimination of these possible sources was mention of return on investment in the same work as information about grants without seeking to provide the details of the connection between the two ideas or a system for calculating the ROI. Among the reports, 216 *Federal Register* announcements were eliminated because they mentioned

ROI without describing an approach or prescribing a pattern of calculation.

## DATA GATHERING AND ANALYSIS

The title and abstract, or title and initial pages of articles without abstracts, were read to identify possible sources. The initial sort identified 93 of the 2,278 search results as potentially relevant. A closer reading of the 93 documents eliminated another 59 of these as sources. Table 2 lists the reasons these articles were removed from consideration.

**Table 1**
**Source Material**

| Source Type | # Articles Available | # Articles Thought Relevant | # Articles Judged Applicable |
|---|---|---|---|
| Scholarly publications | 1,223 | 29 | 14 |
| Dissertations/theses | 435 | 18 | 7 |
| Trade journal articles | 358 | 46 | 13 |
| Reports | 256 | 0 | N/A |
| Conference proceedings | 3 | 0 | N/A |
| Working papers | 2 | 0 | N/A |
| Other | 1 | 0 | N/A |
| ***Total*** | 2,278 | 93 | 34 |

**Note: Excluded sources—articles published prior to 2000; newspaper articles**

**Table 2**
**Winnowing Potential Source Material**

| Source Type | # Articles Thought Relevant | # Articles Judged Relevant | Reason Sources Classified as Irrelevant |
|---|---|---|---|
| Scholarly publications | 29 | 14 | •Grant activity was described but the concept of ROI was applied to a different topic that was also discussed.<br>•While financial or other outcomes were discussed, no attempt was made to associate them with the concept of ROI. |
| Dissertations/ theses | 18 | 7 | |
| Trade journal articles | 46 | 13 | •Grant activity was described but the concept of ROI was applied to a different topic that was also discussed.<br>•Were announcements or descriptions of funded projects that made very general statements.<br>•One article from the *Baltimore Sun* was categorized by ProQuest as a trade journal article. It was removed from consideration since it was a newspaper item. |

A simple form of content analysis (Gall, Gall & Borg, 2010; Neuendorf, 2002) was employed to consider the material ultimately judged to be applicable to the purpose of this review. Each of the articles was read in its entirety, with the particulars of the application of ROI to grants noted. The material captured for each source was the type of publication, author(s), year of publication, title of the article, methodology or evidence pattern employed, and quotes or summaries portraying the application of the concept *return on investment* utilized in the article with respect to grant activity. Patterns in the quotes and summaries were sought and descriptive themes identified.

## RESULTS

The sources identified as relevant appeared in a wide variety of publications and addressed a diverse set of topics. This indicates that interest in ROI for grants is not isolated to a few disciplines or areas of professional practice.

All of the relevant articles in the "scholarly publications" set were from peer-reviewed journals. The 14 relevant scholarly articles represented 11 publications, with *The Lancet* as the most frequent publisher (3 articles) and *Implementation Science* as the second most frequent (2 articles). Four of the 11 publications focused on medicine, with the remainder distributed across science disciplines (4), health (3), promotion of the uptake of research findings (2), and psychiatry (1). Three of the pieces from scholarly journals were editorials or opinion statements rather than research reports. The applicable dissertations were written in the United States and Canada, at institutions in five states and two provinces. The authors had received degrees from schools in the Ivy League, Big Ten, and Atlantic Coast Conference, from prestigious private research-intensive institutions, and from state/province universities. Dissertation topics addressed the fields of corporate culture, institutional change, federal funding guidelines and patterns, community colleges that pursue large grants, research administration and proposal development, corporate philanthropy, project sustainability, and information technology.

The trade journal sources were distributed across the fields of healthcare (6), library science (4), education (2), criminal justice (1), and government (1). Statements of expert opinion were the most common form of trade journal content (6), followed by case studies (5), a report of original survey research (1), a summary of topics and outcomes from a national association meeting (1), and a report regarding published research (1).

In the *Canadian Medical Association Journal*, Frank and Nason (2009) suggested that there are two basic orientations to "proof of value-for-money" in the grant world. Given:

> intense interest in defining the social, health and economic impacts of health research investments globally and in Canada, … 2 main approaches have been used over the past 20 years to measure return on investments….'top-down' econometric calculation…[and] a 'bottom-up'…'payback' model…[which] has involved logic-model tracking of new knowledge" (Frank & Nason, 2009, p. 528).

**Table 3**
**Topics of, Publications for, and Fields of Journal Articles**

| Author(s) and Year | Topic | Journal | Journal's Field(s) |
|---|---|---|---|
| Bisias, Lo & Watkins (2012) | Allocation of NIH funds | *PLoS ONE* | Primary research in science and medicine |
| Chan et al. (2014) | Impacts of research | *The Lancet* | Medicine |
| Couee (2014) | Economic impact of research | *EMBO Reports* | Microbiology |
| Frank & Nason (2009) | Measuring the benefits of research | *Canadian Medical Association Journal* | Medicine |
| Glasgow et al. (2012) | Improving research process | *American Journal of Public Health* | Public health |
| Holmes, Scarrow & Schellenberg (2012) | Translating evidence into science | *Implementation Science* | Scientific study of methods to promote the uptake of research findings |
| Johnston, Rootenberg, Katrak, Smith & Elkins (2011) | Costs and benefits to society of NIH clinical trials | *The Lancet* | Medicine |
| Kalutkiewicz & Ehman (2014) | Metrics for NIH activity | *Nature Biotechnology* | Science and business of biotechnology |
| *The Lancet* (2011) | Reasons to financially support the Global Fund | *The Lancet* | Medicine |
| McIlwain (2010) | Economic return of research | *Nature* | International weekly journal of science |
| Nicol (2008) | Benefits derived from dissemination knowledge | *Health Law Journal* | Health law |
| Rettig (2004) | Suggestions for reorganizing the National Institutes of Health | *Health Affairs* | Health |
| Stone & Lane (2012) | Beneficial impacts of research | *Implementation Science* | Scientific study of methods to promote the uptake of research findings |
| Weiss (2007) | Measuring the impacts of medical research | *American Journal of Psychiatry* | Psychiatry |

This description parallels the orientations described by Weiss (2007): "financial outcomes measures" and "impact…on the end user" (p. 206). These two definitions proved to be accurate representations of the content of the scholarly publications (Table 4), that of the trade journals (Table 5), and that found in the dissertations. Some authors used both meanings in their presentation. There were also some idiosyncratic applications of ROI, such as Bisias, Lo, and Watkins' use as "impact on U.S. years of life lost" (2012, p. 1) but each of these fit within Frank and Nason's "payback" (benefit derived) category.

The shortest article from a scholarly journal, an editorial board opinion statement, did not clearly define the intended meaning of return on investment. Eight of the 14 sources used both of the observed patterns of meaning for ROI within one article, five used just one definition of the phrase (one econometric and four benefit derived), and three of the 14 sources were written to critique use of the ROI concept in evaluating grant-funded activity. Five of the trade journal sources used return on investment with respect to grants in a strictly financial sense, three applied the concept strictly as a consideration of benefits derived, and three used both meanings. Two of the trade journal sources did not clearly define the intended meaning of return on investment even though they connected the idea directly to grant activity. The dissertations did not depart from the usage pattern described by Frank and Nason (2009) and Weiss (2007) that has been illustrated here with the scholarly and trade publication content.

A small but focused subset of the scholarly and trade journal articles considered the effectiveness of applying the concept of ROI to grant activity. These concerns were the primary topic of five of the 34 sources considered in this review, and formed a substantial concern in two other sources. The seven sources that critiqued application of ROI in the context of grant-funded activity were all opinion pieces, with five appearing in scholarly journals (Couee, 2013; Frank & Nason, 2009; McIlwain, 2010; Nicol, 2008; Weiss, 2007) and the other two in trade journals (Corbyn, 2009; Moriarty, 2010).

Multiple authors suggested categories in which the outcomes and benefits of grant-funded activity could be considered. These categories generally described broad themes summarizing types of derived benefits. However, several authors extended their treatment beyond simple categorization to

**Table 4**
**Uses of the Phrase "Return on Investment" in the Scholarly Literature**

| Author(s) and Date | Topic | Pattern of Use for "Return on Investment" |
|---|---|---|
| Econometric Orientation (including authors arguing against this pattern) | | |
| Bisias, Lo, & Watkins (2012) | Proof-of-concept for a quantitative method of allocating NIH funds | "…is analogous to managing an investment portfolio: in both cases, there are competing opportunities to invest limited resources" (p. 2). |
| Couee (2013) | Opinion regarding "procedures and standards, such as applying economic principles of quality assurance to research" (from abstract) | "…governments and funding agencies are increasingly interested in the performance and cost efficiency of specific research institutes, projects, teams and individuals. To make these 'value-for-money' assessments, many countries rely on agencies and define criteria to evaluate research and carry out academic benchmarking" (p. 222). |
| Frank & Nason (2009) | Measuring social, health, and economic benefits of research | "…intense interest in defining the social, health and economic impacts of health research investments globally and in Canada as proof of value-for-money" (p. 528).<br><br>" …model that "monetized improvements in life expectancy and quality of life" (p. 528). |
| Johnston, Rootenberg, Katrak, Smith & Elkins (2011) | Effect of NIH clinical trials on public health | "…at a total cost of $3.6 billion…net benefit to society at ten years was $15.2 billion" (p. 1319). |
| Kalutkiewicz & Ehman (2014) | Metrics for NIH activity | **"…**economically productive use of taxpayer dollars…. It has been estimated that approximately 30% of the total value of the NASDAQ has roots in academic research. More specifically, a 2008 study concluded that every $1 spent on NIH research results in $2.21 in local economic impact" (p. 536). |
| McIlwain (2010) | Considers case for economic return of research | "Collins has recently cited a report by Families USA, a Washington DC-based health advocacy group, which found that every US $1spent by the NIH typically generates $2.21 in additional economic output within 12 months" (p. 682). |
| Nicol (2008) | Types of return for dissemination of knowledge generated | "…provides return on investment, potentially allowing them to reduce…monetary contribution" (p. 210).<br><br>"…benefits in terms of financial return on investment" (p. 234). |
| Stone & Lane (2012) | Proposes logic model-based system for consideration of "the intended beneficial impacts" | "…a return on the public investment can be realized through three outcomes: broad and economical…, revenue from sales captured as profit…, and generation of new tax revenue" (p. 16). |
| Weiss (2007) | Measuring the impact of medical research | "…financial outcomes measures seem removed from the core mission of academic medical research" (p. 206). |
| Payback (Benefit Derived) Orientation | | |
| Bisias, Lo, & Watkins (2012) | Proof-of-concept for a quantitative method of allocating NIH funds | ROI as "impact on U.S. years of life lost" (p. 1). |

| | | |
|---|---|---|
| Chan et al. (2014) | Opinion about improving understanding of research and its impact | "Because unreported studies do not contribute to knowledge, they do not provide returns on the investment of research resources or the contributions of participants" (p. 257). |
| Frank & Nason (2009) | Measuring social, health, and economic benefits of research | "'…bottom-up'…'payback model'…has involved logic-model tracking of new knowledge in phases from knowledge production at the researcher level…to secondary outputs and adoption to final outcomes" (p. 528). |
| Glasgow et al. (2012) | Proposes ways to improve progress from idea dissemination to implementation research | "…true return on research investment requires improvements in the adoption and implementation of effective interventions within discrete clinical and community settings" (p. 1277). |
| Holmes, Scarrow & Schellenberg (2012) | Description of "how one funding agency determined its [knowledge translation] role and…developed a model" (p. 1) | "…return on investments in health research in the form of societal and health system benefits" (p. 1). |
| Johnston, Rootenberg, Katrak, Smith & Elkins (2011) | Effect of a NIH program of clinical trials on public health and resulting costs | "…effect of trial results on medical care and health" (p. 1319). |
| Kalutkiewicz & Ehman (2014) | Metrics for NIH activity | "…the return on investment for NIH research should be measured in terms of extended human life expectancy, reduced burden of disease, and long-term economic impact" (p. 537). |
| McIlwain (2010) | Considers case for economic return of research | "Biomedical research has generally been looked at for its health benefits" (p. 682). |
| Nicol (2008) | Types of return for dissemination of knowledge generated | "…10% social rate of return based on building of the basic knowledge stock" (p. 215). |
| Rettig (2004) | Discusses recommendations made regarding reorganization of NIH | ROI as "improved health of the American public" (p. 257). |
| Stone & Lane (2012) | Proposes logic model–based system for consideration of "intended beneficial impacts" (from abstract) | "…bibliometrics about research outputs (published discoveries),…transfer metrics about development outputs (patented prototypes)" (p. 1). |
| Weiss (2007) | Measuring the impact of medical research | ROI "aligned with the amelioration of disease" (p. 206).<br><br>"…impact of these activities on the end user…[as] measurement of outcomes" (p. 206). |
| Unclear What Pattern is Meant | | |
| *The Lancet* (2011) | Five reasons to financially support the Global Fund | Uses "largest and broadest return on investment" in undefined sense (para. 2). |

**Table 5**
**Uses of the Phrase "Return on Investment" in Trade Journals**

| Author(s) and Date | Topic | Pattern of use for "Return on Investment" |
|---|---|---|
| Econometric Orientation (including authors arguing against this pattern) | | |
| Anonymous (2011) | Dept. of Energy reporting about ARRA's impact on the smart grid | "…return on investment (ROI) and could help make the case for utilities to further invest…[because] the savings from increased efficiency make up for the investment" (para. 6). |
| | | |
| Berry (2014) | Transformation of Alberta's Edmonton Public Library | "…the program allowed savings or reallocation of over $3.56 million in Canadian dollars…to Edmonton's downtown…with an initial investment of $630,000 Canadian" (para. 8). |
| Channing (2012) | Sinai Health System's community health educator program in pediatric asthma | "…for every dollar we invest…we have precluded spending up to $15 in hospital emergency department visits or inpatient admissions - an incredible return on investment" (para. 10). |
| Corbyn (2009) | Discusses the absence of metrics in ARRA funding | "…what level of economic return can taxpayers reasonably expect for their investment" (para. 7). |
| Flagg (2005) | Report on American Library Council meeting | "LSTA funding…reached an estimated value of over $21 million – a 13-to-1 return on investment" (para. 28). |
| McCune (2007) | Tips for grant success | "…funders view their financial support as an investment in your library" (para. 25). |
| Moriarty (2010) | Critique of changes in the British government's grant-funding patterns | "…prioritise research areas on the basis of their perceived impact on the economy" (para. 3).<br><br>"…direct, short-term effect on the economy" (para. 9). |
| STEM Cell Week (2007) | Proposed changes to intellectual property regulations | "…potential to diminish a grantee's return on investment, increasing financial risk" (para. 3) |
| Payback (Benefit Derived) Orientation | | |
| Bawden et al. (2010) | Evaluation of an emergency medicine national research grant competition | "…dedicated EM research funding should be continued to stimulate productivity" (p. 33). |
| Brunell (2009) | Report on a nursing grant project | "…maximizing use of current and preparing for future technology" (para. 8). |
| Corbyn (2009) | Discusses the absence of metrics in ARRA funding | "quality-of-life or public-policy benefits" (para. 15). |
| McCune (2007) | Tips for grant success | "…actual return on investment …. Although not all results are quantifiable, you should have some sort of evaluation to determine if your proposal will have made an effect or a positive change" (para. 19). |
| Moriarty (2010) | Critique of changes in the British government's grant-funding patterns | "J.J. Thomson, discoverer of the electron, said.…'Research in pure science is made without any idea of application to industrial matters, but solely with the view of extending our knowledge of the laws of Nature'" (para. 10). |
| Raths (2009) | Considerations related to seeking grants | "…share data points - qualitative and quantitative about return on investment, both in terms of patient health and improved efficiencies" (para. 27). |
| Unclear What Pattern is Meant | | |
| Gavigan (2008) | Police communications | Advocates seeking "grants because the return on investment (ROI) can be huge" (para. 16). |
| McGill (2013) | Learning taking place at HRSA-funded centers | "We have to keep our ears to the community to make sure we're providing the best return on investment we can for the funding we do get" (p. 3). |

suggesting systems for analysis of benefits derived from grant-funded research.

## LIMITATIONS

The primary limitation applicable to this review is that it is the work of one person. Any bias he had regarding the topic could have influenced data-gathering, data analysis, and presentation of results. The methodology employed, incorporating comprehensive consideration of the literature available on the ProQuest database, pre-specified criteria, organic development of categories and labels, and frequent crosschecks of data and results, was chosen as a means of minimizing both bias and human error.

## DISCUSSION AND CONCLUSIONS

The purely fiscal sense of return on investment is unlikely to disappear from the discussion of grants. Several of the sources cited in this review described governments' increasing emphasis on the economic impact of the research they fund; in the U.S. (Kalutkiewicz & Ehman, 2014; McIlwain, 2010), in Canada (Frank & Nason, 2009; Joosse, 2009), and in the United Kingdom (Corbyn, 2009; Moriarty, 2010). The issue is and is likely to remain, "what level of economic return can taxpayers reasonably expect for their investments" (Corbyn, 2009. para. 7)? Yet the presence of two patterns of usage for return on investment in reference to grant-funded activity, "econometric" (Frank & Nason, 2009, p. 528) and the broader set of benefits derived ("impact of these activities;" Weiss, 2007, p. 206), brings an issue into focus.

Corbyn (2009) cites Mansfield's 1991 study, which showed $0.28 annual return in perpetuity for every $1 in grant funds distributed. McIlwain (2010) referenced "a report by Families USA…which found that every US $1 spent by the NIH typically generates $2.21 in additional economic output within 12 months" (2010, p. 682). According to no lesser authority than Dr. Francis Collins, the director of the National Institutes of Health, "[b]iomedical research has generally been looked at for its health benefits, but the case for it generating economic growth is pretty compelling" (p. 682). However, a small but noteworthy cohort of authors believes this perspective is based on a flawed application of ROI (Collins quoted in McIlwain, 2010).

That "academic research has a direct, short-term effect on the economy" (Moriarty, 2010, para. 9) is the basis of the objections to a solely economic perspective of grant ROI. McIlwain noted that, "some economists question the basic assumption behind such models" (2010, p. 682) (i.e., direct linear relationships between grant funds invested and economic output). In

fact, McIlwain also stated that no one can assert "a certain amount of research input will generate corresponding economic outputs" (p. 682) of a known degree or breadth. This is the case as "[t]he economic impact of research is felt in myriad ways, both direct and indirect" (Corbyn, 2009, para. 20). Even should one be able to plan and capture measures of all direct impacts, preparing a plan to measure indirect or spillover impact implies a prescience that simply is not possible. A related consideration is the presence of confounding influences. It is possible for short-term impact to be blunted or blocked by circumstances external to a project such as institutional reallocation of resources or personnel, competing initiatives, and social or cultural pressures that affect participation. Long-term impacts, like the success or failure of a business venture developed from a grant-funded project, can also be influenced by multiple factors. A lack of success "could be just as much to do with a failed marketing campaign as the innovation itself" (Corbyn, 2009, para. 25), thereby violating the notion of direct, linear relationships between funding and its impacts. Even the abbreviated list of examples shared here indicates that the relationship of grant project or process to impact may not be direct and certainly is not linear.

Due to the lack of linear relationships, the foremost argument against the application of fiscal ROI to grant activity is that it does not conform to the patterns necessary for the calculation. Corbyn stated that, "[m]easuring the economic return on investment from scientific research is a difficult, if not impossible, task" (2009, para. 9) and "[t]rying to put a number on it is a 'pretty fruitless task,' particularly if quality-of-life or public-policy benefits are being fitted with pound signs" (para. 15). As McIlwain (2010) noted, "[a] key problem…has been economists' inability to measure the costs of research as well as the benefits" (p. 684). This circumstance prevents accurate calculation of return on investment as one must know and take into account the inputs (costs) and the outcomes (benefits). If the factors included in the calculation fall short of a "full accounting" or are skewed based upon preference or perspective, "the resulting ROI figures can be meaningless" (Wheelen & Hunger, 2004, p. 258). One need only consider Bloomgarden's suggestion of "prestige generation" (2008, p. 19) or the descriptions of grant ROI selected from some of the sources for this review (Table 6) to see the variety of perspectives regarding grant

outcomes—many of the suggested outcomes would be a challenge to measure in a manner that would facilitate monetary valuation and ROI calculation.

**Table 6**
**Selected Phrases Used by Sources to Describe ROI**

| Source | Description Applied | Source | Description Applied |
|---|---|---|---|
| Berry (2014) | Social return | Kalutkiewicz & Ehman (2014) | Extended human life expectancy |
| Bisias, Lo, & Watkins (2012) | Years of life lost | | Reduced burden of disease |
| Bradford (2008) | Cultural ROI | | Long-term economic impact |
| Corbyn (2009) | Economic return | Litwin (2008) | Change in market share |
| Eckert (2011) | Indications of desired impact | McCune (2007) | Measured outcomes |
| | Social and business value | McIlwain (2010) | Health benefits |
| | Customer loyalty | | Generating economic growth |
| Frank and Nason (2009) | Life expectancy | Mills (2008) | Tangible products |
| | Quality of life | Moriarty (2010) | Direct, short-term effect on the economy |
| Gavigan (2008) | Benefit derived | Chan et al. (2014); Moriarty (2010) | Extending knowledge |
| Glasgow et al. (2012) | Societal benefits | Raths (2009) | Data regarding patient health |
| | Health system benefits | | Data regarding improved efficiencies |
| Johnston, Rootenberg, Katrak, Smith & Elkins (2011) | Effects on medical care | Rettig (2004) | Improved health of the U.S. public |
| | Effects on health | Weiss (2007) | Amelioration of disease |

Nicol (2008) noted the possibility of a variance of perspectives regarding a single project, saying that individuals with differing sets of responsibilities and backgrounds are "likely to bring quite different interests and experience to the…table. University administrators are likely to focus on cost recovery whereas the driver for industry is product development" (Nicol, 2008. p. 212). This can produce a "clash of cultures" (ibid.) around what constitutes acceptable and desirable outcomes and measures. Litwin (2008) addressed this issue clearly in his dissertation: "If there is no generally accepted method of measuring

success…then return on investment in research capacity cannot be measured" (p. 93).

It is a practical impossibility to track and assign a monetary value to all direct and indirect inputs and outcomes that occur in grant-related activity, from proposal production to project implementation and management and on to long-term impacts (both anticipated and unanticipated). As a result, values calculated for grant ROI are speculative or context-limited at best and may even be spurious. This conclusion has been reached by multiple parties. Frank and Nason (2009) directly stated that no validated method for measuring return on investments for grants exists. Stone and Lane (2012) concurred, noting "the absence of comprehensive models and metrics" (p. 1), as do Corbyn (2009), Couee (2013), McIlwain (2010), Moriarty (2010), and Nicol (2008).

The second line of argument against calculation of fiscal ROI for grant-funded activity is the presence of erroneous assumptions. As has just been noted, "there is no consensus about what constitutes impact" (Corbyn, 2009, para. 9; see also Table 6), nor is there consensus about which potential impacts should be considered for various types of projects. Thus, the assumption that grant impacts are known and can be consistently measured is flawed. Without common understanding of what "impact" entails and how to capture a reliable measurement of it, even the most meticulous of calculations become limited and overly context-specific.

The application of fiscal ROI to grant-funded projects assumes simple, uniform measurement. Yet the measurements taken cannot be simple, as they address complex and sometimes conflicting constructs (Table 6). The complication of comparing ROI across research contexts and projects is an apt illustration. As a UK expert, Ben Martin of the Institute of Science and Technology Policy Research at the University of Sussex, has asked, "'How do you weigh up Pounds 1 billion of spin-off increases against a potential policy outcome of 100,000 fewer people becoming obese'" (Martin, quoted in Corbyn, 2009, para. 40)? In addition, the measures of process and products in grant activity are not uniform. Research practice is dynamic, with new developments occurring annually and with a variety of tools and applications available to accomplish similar purposes. While scientific enquiry dictates consistency in process within an investigation or intervention, it is possible for advancements and alterations to occur between funding cycles. The support facilities, research

venues, and project personnel may change for a single continuous project from one funding cycle to the next, introducing variations in resource inputs as well as in expertise and insight. Lead investigators and their colleagues continue to learn and to be influenced by the work of others as it becomes available, altering their understanding and perspectives. These phenomena call into question the assumption that ROI calculations completed even three years ago will represent the same set of inputs and behaviors as calculations for the same project or similar projects at present. Even changes in funder reporting standards can impact practice in currently funded projects. Corbyn (2009) provided an example of rapid change of this type. When the British government "made the number of spin-offs a key indicator of the success of knowledge-transfer activities …. Numbers increased nearly threefold" (para. 27) in one year. But that "'did not mean that [the researchers] suddenly became three times better at technology transfer and generating economic impact…it meant…that once it became a performance indicator, everybody started maximising their score'" (Corbyn, 2009, para. 28). Variation and malleability of the kind described above decidedly limits the ability to argue for simple, uniform measurement with respect to grant projects undermining the applicability of fiscal ROI calculation.

Comparing calculated ROI between projects or programs assumes that the inputs, processes, and outcomes are transferable from setting to setting. Yet "[l]ittle is known about…the extent to which the benefits of research done in one country or region are specific to that area" (McIlwain, 2010, p. 684). Ignoring this principle when seeking to summarize impact contradicts what is considered by funders to be best practice. Funding organizations do not generally assume uniformity from one setting to the next. This is the reason for inclusion of proof of replicability in proposals and for the funding of validation, replication, and dissemination studies.

Another flawed assumption in applying a fiscal concept of ROI to grant activity is the ability to establish appropriate periods in which to measure impacts, especially in respect to research outcomes. There can be extended waits before a research product has a discernable impact (Kalutkiewicz & Ehman, 2014; Nicol, 2008). Indeed, "[l]ittle is known about how long the economic benefits of research take to accrue" (McIlwain, 2010, p. 684). Since little is known about the period of time necessary for economic benefit to be derived, any

pattern utilized becomes a best guess. Chance or ancillary outcomes are a related concern. It is not uncommon for grant-funded projects of all types to have unexpected outputs or outcomes. Many research discoveries from "antibiotics to nuclear magnetic resonance have had huge economic impact, but were both serendipitous and did not hit pay dirt for many years" (Corbyn, 2009, para. 23).

Those citing well-known reports and studies in support of calculating fiscal ROI for grants appear to ignore the shortcomings of the reports they cite. Dr. Benjamin Martin professor of science and technology studies at the University of Sussex describes the classic example, Mansfield's 1991 analysis, as "too good to be true" indicating it "rested on 'heroic assumptions' and 'flawed methodology'" (Corbyn, 2009, para. 17). McIlwain (2010) agrees: Mansfield's data was developed "by interviewing chief executive officers, asking them what proportion of their companies' innovation was derived from university research work" (McIlwain, 2010, p. 683). It is essentially a summary estimate based on individual estimates provided by a limited convenience sample, 76 CEOs, "who were pushed by the economist to give answers" (Corbyn, 2009, para. 17) in an arena of activity about which they were likely to be favorably biased. Mansfield's work is not an isolated instance. Robert Topel of the University of Chicago observes, "'It is very hard to take changes in public health and attribute their cause'" (McIlwain, 2010, p. 684). Yet this is the overt purpose of frequently cited reporting regarding ROI of funded research. Several examples are *Exceptional returns: The economic value of America's investment in medical research* and *Rising above the gathering storm* (National Academies, 2007), publications compiled by lobbyists and government-funded committees. McIlwain's view is that the "economic benefits of research have been extrapolated from a small number of studies, many of which were undertaken with the explicit aim of building support for research investment, rather than being objective assessments" (McIlwain, 2010, p. 682). The American (Kalutkiewicz & Ehman, 2014; McIlwain, 2010), Canadian (Frank & Nason, 2009; Joosse, 2009), and British governments (Corbyn, 2009; Moriarty, 2010) are actively gathering information in these areas and it is hoped that they can improve on the current state of affairs.

It is naturally important to employ some form of measurement for the eventual benefits of grant-funded activity. Weiss (2007) proposed three reasons for this:

(1) "measuring outcomes provides a clear and meaningful message regarding the return on investment to the major funders" (p. 207); (2) outcomes measurement "serves as a compass to keep our research efforts, individually and collectively, on track" (ibid.); and (3) this measurement "makes explicit the societal good embedded in…research" (ibid.). However, "[t]he absence of comprehensive models and metrics skews evidence gathering" (Stone & Lane, 2012, p. 1) toward the proximal and the easily chronicled. This becomes "problematic…as most measurable socioeconomic benefits" (ibid.) occur through "commercial innovation" (ibid.), and, as a result, are very long-term measures without readily predictable paths.

Even with respect to socioeconomic benefits, there will be a wide variety of possible measures. Dr. Benjamin Martin of the University of Sussex believed that "you can capture economic impact, but…need a 'vast array' of indicators - about 65" (Martin, quoted in Corbyn, 2009, para. 26). This matches the system described by Frank and Nason *(2009) which includes "a starting menu of 66 preferred indicators designed to answer a number of potential impact questions" (p. 532) and the potential for development of other indicators. Nicol (2008) agreed that there are a variety of valid metrics, resulting in what is unlikely to be a simple system of measurement or one that is chiefly focused on fiscal ROI.

Weiss' statement of reasons to compile ROI information, referring to both the fiscal outcomes and benefits-derived definitions of ROI, summarizes the need for clear and balanced activity in this area. Having a means of chronicling "the outcomes of…work would provide…funders with clearer mission-central return-on-investment feedback, would make explicit the benefits of science to an increasingly skeptical public, and would serve as a… guide the scientific community" (Weiss, 2007, p. 206).

## RECOMMENDATIONS

Consideration of return on investment has a place in the grant world, even though fiscal ROI should be viewed as a tool that is limited in accuracy, scope, and applicability. Therefore, it is incumbent on grant professionals to utilize the most appropriate patterns and understandings for assessment of the benefits of grant-funded activity, rather than the most convenient, and to advocate for the most appropriate patterns with administrators, government officials, faculty, and peers so that these patterns become and remain the "best practice" in research administration.

Toward this end, the *benefits derived* perspective on ROI should become the preferred perspective in a grants context. This is the view of the Research Councils of the United Kingdom, which suggested "a broad approach to describing the impact of research" (Research Councils of the United Kingdom, quoted in Corbyn, 2009, para. 35). The goal is to look "at economic effects, [but]…also consider social benefits such as improved public-policy and quality-of-life outcomes" (Corbyn, 2009, para. 15) by integrating case studies in order to "achieve an 'ever more persuasive' evidence base for the impact of research council funding" (Corbyn, 2009, para. 38). Methodology in gathering qualitative accounts and in making generalizations from these accounts becomes a concern in this approach, but a purely quantitative fiscal mode of consideration poses equal, if not greater, concerns and limitations, as argued above.

In order to forego a "clash of cultures" (Nicol, 2008, p. 212) around what constitutes acceptable and desirable measures, it would be wise to follow the focus on the purpose behind measurement stressed by Weiss (2007), Moriarty (2010), and Couee (2013). Put simply, assessment will be ineffective without an identified purpose for the measurement and analysis conducted. Thonon et al. (2015) provided a strong example of identified purpose of assessment: "[a]ccording to the Canadian Academy of Health Sciences, evaluation of research is carried out for three main purposes: accountability purposes, advocacy purposes, and learning purposes" (p. 2). Several authors of dissertations suggested different patterns for organizing the basic purposes of grants: Mills (2008) suggested that institutions of higher education (IHE) assess tangible products in three areas, "core mission areas of instruction, research, and public service" (p. 30) while Eckert (2011) suggested that corporate funders are attuned to achieving "both social and business value" (p. 71). Nicol (2008) noted that each stakeholder or group is likely to have "quite different interests and experience" (p. 211), which will influence their perspective of the benefits to be considered. The most direct way to resolve differences of this type is to clearly identify the entity's purposes for the enterprise and seek to measure according to these purposes.

As highlighted in Nicol (2008), different purposes for grant-funded activity exist with respect to each stakeholder and organization, specific undertakings, and each funder. In several countries, funding agencies supported by the national government are actively engaged in the

development or early implementation of reporting systems that seek to capture more and more relevant data related to projects they fund. However, this does not resolve the matter for institutions of higher education, non-profits, healthcare entities, or other organizations receiving grants specific to their own unique interests. Funding-program-level or even national-level summation of impacts does not address institutional, local, partnering organization, or individual outputs and outcomes, unless very few projects are being funded at the national level. IHEs and other funded parties must resolve this challenge for and within their own purposes and setting. Two immediately accessible approaches can be taken, or even combined, to meet this need. These are an institutional values-specific benefit analysis process and a balanced scorecard approach.

Uttam and Venugopal (2008) developed a quantitative benefit analysis system that takes institutional purposes into account. While the system was devised in India for a research laboratory, its basic structure and essential elements are easily adaptable for organizations that receive grant funding in any part of the world. Uttam and Venugopal's system plots points on a four-quadrant graph by using values from a "contract value index" (p. 60) and a "potential benefits index" (p. 59). The contract value index is a simplified ROI calculation, the "ratio of the actual contract fee realized from a [project] to the prevailing man-year rates of the organization" (p. 60). The man-year rate comprises all known organizational costs for the program, staff time, direct costs, and indirect cost, calculated as a yearly average. While as described above, this is likely inadequate for an accurate ROI calculation, utilizing this pattern for all projects will allow comparison of similar sets of summary data (known costs). Potential benefits ratings result from consideration of a ten-item list that can be weighted in favor of primary purposes while still considering other goals. In the process, organizations rate projects according to known institutional priorities. Both scores are then plotted on a four-quadrant graph allowing comparison of projects. To aid with comparison and characterization of projects, categorical descriptions for each quadrant of the graph were created ("move away," "futuristic," "desirable," and "beneficial" [Uttam & Venugopal, 2008, p. 65]). Uttam and Venugopal completed a proof-of-concept study with historical data from their organization and used the data from that pilot for their 2008 publication. Their system allows quantitative comparison of

projects and aids in determining the relative value of each project to the organization, from nominal value without the potential for long-term impact ("move away") to a "high level of…long-term benefits and…substantial revenues upfront" ("desirable") (Uttam & Venugopal, 2008, p. 65).

Another immediately applicable assessment system can be used in conjunction with Uttam and Venugopal's pattern or on its own. This is rubric-based evaluation or a "balanced scorecard," a pattern long employed in business settings (Wheelen & Hunger, 2004). This system includes "nonfinancial as well as financial measures" (p. 250), requires measurable objectives (e.g., SMART goals) and key performance indicators for each objective, and as a result is customizable, with institutional goals directing the formation of the scorecard.

**Table 7**
**Illustration of Project Purposes Divided Categorically**

| Spheres of Measurement | Possible Considerations |
|---|---|
| Fiscal | Fiscal purposes for grants are limited to *input concerns* like volume, resourcing, and consistency (e.g., gradually decreasing institutional dollars supporting the project, provision of all equipment required to initiate the project) and *results* in two categories: outputs (e.g., licensable product developed) and outcomes (e.g., spin-off company established). |
| Stakeholder | A *variety of stakeholders* exist who may have identifiable purposes related to a grant-funded project. Examples are the funder, the awardee organization, the research team, the entity of which the awardee organization is a member (e.g., state university system office), student workers, participants, and the public. |
| Innovation and learning | Innovation and learning purposes are limited to the *behavioral* (e.g., process initiated, contacts made, counseling provided) and *result* spheres (e.g. increased performance, completion of a credential). |
| Impact | Impact purposes can occur in respect to the *setting* (e.g., improved process, facilitating multiple projects through acquisition of a large item of equipment), the *field of the investigation* (e.g., new method or knowledge), or *society* (e.g., improved healthcare delivery). |

To employ a balanced scorecard system, the first topic to consider is the purpose(s) for the project or initiative. These can be classified in four categories: fiscal, stakeholder, innovation and learning, and impact. It should be noted that a project may have more than one purpose in a category or purposes in several of the categories. A SMART goal should be written for each identified purpose. To

establish the key performance indicators for the SMART goal(s), a series of questions are asked starting with identification of the purpose. These are: (1) What is the purpose (or what are the purposes) for undertaking this project and the associated standard(s) by which success will be measured?; (2) Is this measurement a process (chronicling activity) or product (chronicling results) consideration?; (3) Is this a fiscal, stakeholder, innovation and learning, or impact measure?; (4) Does the measure require monitoring of inputs, activities, or results?; (5) If a result is in view, is this an output or an outcome concern?; (6) What data will be required for the proposed measurement, and are they qualitative, quantitative, or are both needed?; and (7) How will the data be processed or analyzed? Once these questions have been answered for each goal, a simple table can be constructed listing the project objectives (SMART goals) in the left-hand column and the performance indicator (the standard against which performance will be compared) in a middle column, leaving room in the right-hand column for the material generated by completing the measurement. The result is a clearly defined rubric for assessing performance in a project. In this system, it is only possible to compare performance data between projects should they have exactly the same set of purposes and performance measures, which is unlikely. However, the system does make it possible to summarize project results that are associated with various institutional purposes and note the achievements in each area.

**Table 8**
**Example of a Balanced Scorecard for a Grant Project**

| SMART Objective | Performance Indicator | Measure |
|---|---|---|
| ***Fiscal Purposes*** | | |
| 1. SMART Objective for the first fiscal measure. | Baseline or standard | Measure taken |
| 2. SMART Objective for the second fiscal measure. | Baseline or standard | Measure taken |
| ***Stakeholder Purposes*** | | |
| 1. SMART Objective for the first stakeholder measure. | Baseline or standard | Measure taken |
| 2. SMART Objective for the second stakeholder measure. | Baseline or standard | Measure taken |
| ***Innovation and Learning Purposes*** | | |
| 1. SMART Objective for the first innovation and learning measure. | Baseline or standard | Measure taken |
| 2. SMART Objective for the second innovation and learning measure. | Baseline or standard | Measure taken |
| ***Impact Purposes*** | | |
| 1. SMART Objective for the first impact measure. | Baseline or standard | Measure taken |
| 2. SMART Objective for the second impact measure. | Baseline or standard | Measure taken |

Organizations receiving grant funding are called upon by the funder, the organization's internal and external stakeholders, and the public to demonstrate responsible use of resources, including noting benefits derived from the projects. A thoughtfully prepared and applied system is a must for completing this process. While this task is not as simple as some would like for it to be, consistent application of well-constructed approaches can produce meaningful results.

## LITERATURE CITED

Anonymous. (2011, August 6). Clinical research; UCSF receives $112 million to help translate science into cures. *Obesity, Fitness, and Wellness Week.*

Bawden, J., Manouchehri, N., Villa-Roel, C., Grafstein, E., & Rowe, B. (2010). Important returns on investment: An evaluation of national research grants competition in emergency medicine. *Canadian Journal of Emergency Medicine, 12*(1), 33–38.

Bisias, D., Lo, A., & Watkins, J. (2012). Estimating the NIH efficient frontier. *PLoS ONE, 7*(5), 1–10.

Berry, J. N. (2014). Transformed by teamwork. *Library Journal, 139*(11), 30–35.

Bloomgarden, A. H. (2008). Prestige culture and community-based faculty work. Unpublished doctoral dissertation. Retrieved from the ProQuest database. UMI number: 3336986.

Bradford, C. S. (2008). *Significance of institutional performance factors in the allocation of state appropriations to public research universities*. Unpublished doctoral dissertation. Retrieved from the ProQuest database. UMI number: 3337342.

Brunell, M. L. (2009, September). Florida receives Partners Investing in Nursing's Future grant. *The Florida Nurse,* 17.

Chan, A-W., Song, F., Vickers, A., Jefferson, T., Dickersin, K., Gotzsche, P., Krumholz, H., Ghersi, H. & van der Worp, H. (2014). Increasing value and reducing waste: addressing inaccessible research. *Lancet, 383*, 257–266.

Channing, A. H. (2012, March/April). Overcoming barriers through community engagement. *Healthcare Executive,* 27(2), 64–66.

Corbyn, Z. (2009, April 30). Bang for your bucks. *The Times Higher Education Supplement,* 32.

Couee, I. (2013). The economics of creative research. *EMBO reports, 14*(3), 222–225.

Eckert, L. M. (2011). *Private dollars in public education: corporate philathropy in K–12.* Unpublished doctoral dissertation. Retrieved from the ProQuest database. UMI number: 3486023.

Flagg, G. (2005, August). ALA Council. *American Libraries, 37*(7), 73–75.

Frank, C. & Nason, E. (2009). Health research: Measuring the social, health and economic impacts. *Canadian Medical Association Journal, 180*(5), 528–534.

Funding First. (2001). *Exceptional returns: the economic value of America's investment in medical research.* New York, NY: The Lasker Foundation.

Gall, M. D., Gall, J. P. & Borg, W. R. (2010). *Applying educational research* (6th ed.). Boston, MA: Person Education, Inc.

Gavigan, J. (2008, November). The state-of-the-art police agency: information technology. *Law and Order, 56*(11), 24–26, 28–31.

Glasgow, R. E., Vinson, C., Chambers, D., Khoury, M. J., Kaplan, R. & Hunter, C. (2012). National Institutes of Health approaches to dissemination and implementation science: current and future directions. *American Journal of Public Health, 102*(7), 1274–1281.

Holmes, B., Scarrow, G., & Schellenberg, M. (2012). Translating evidence into practice: The role of health research funders. *Implementation Science, 7*, 1–10.

Investopedia. (2015). Return on investment - ROI. Retrieved from: http://www.investopedia.com/terms/r/returnoninvestment.asp

Johnston, S. C., Rootenberg, J. D., Katrak. S., Smith, W. S., & Elkins, J. S. (2006). Effect of a US National Institutes of Health programme of clinical trials on public health and costs. *The Lancet, 367*, 1319–1327.

Joosse. G. (2009). *Revolutionary changes in Alberta post-secondary funding: Comparison of two college's responses*. Unpublished doctoral dissertation. Retrieved from the ProQuest database. ISBN: 978-0-494-49644-2.

Kalutkiewicz, M. J., & Ehman, R. L. (2014). Patents as proxies: NIH hubs of innovation. *Nature Biotechnology, 32*(6), 536–538.

*The Lancet.* (2011). Five reasons to fund the Global Fund. *The Lancet, 378*, 1198.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. A. P., Clarke, M., Devereaux, P. J., Kleijnen, J. & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ, 399*(b2700). doi:10.1136/bmj.b2700

Litwin, J. M. (2008). *The efficacy of strategy in the competition for research funding in higher education*. Unpublished doctoral dissertation. Retrieved from the ProQuest database. ISBN: 978-0-494-39945-3.

McIlwain, C. (2010). What science is really worth. *Nature, 465*(10), 682–684.

Mansfield, E. (1991). Academic research and industrial innovation. *Research Policy, 20,* 1–12.

McCune, B. (2007, July/August). 10 tips for getting grants to keep your library afloat. *Computers in Libraries, 27*(7), 10–12.

McGill, N. (2013). Training centers keep public health workers knowledgeable. *The Nation's Health, 43*(2), 1, 12.

Mills, G. E. (2008). *An exploration of the factors that influence the use of information technology for institutional effectiveness in terms of the research and learning productivity of a college or university.* Unpublished doctoral dissertation. Retrieved from the ProQuest database. UMI number: 3321505.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*, 332–336.

Moriarty, P. (2011, August 4). False economies. *The Times Higher Education Supplement, 2010,* 26.

National Academy of Sciences. (2007). *Rising above the gathering storm: Energizing and empowering America for a brighter economic future*. Washington, DC: The National Academies Press.

Neuendorf, K. (2002). *The content analysis guidebook.* Thousand Oaks, CA: Sage Publications.

Nicol, D. (2008). Strategies for dissemination of university knowledge. *Health Law Journal, 16*, 208–235.

Preuss, M. (2015). Assessing grant capacity and readiness: A systematic review of the periodical literature of research administration. *Research Management Review, 20*(2), 1–18.

Raths, D. (2009, January). Ask nicely. *Healthcare informatics, 26*(1), 42–45.

Rettig, R. A. (2004, January/February). Reorganizing the National Institutes of Health. *Health Affairs, 23*(1), 257–262.

*Stem Cell Week*. (December 3, 2007). Regenerative medicine: California Healthcare Institute submits statement to California Institute for Regenerative Medicine Revised Intellectual Property Regulation. *Stem Cell Week,* 137.

Stone, V. I., & Lane, J. P. (2012). Modeling technology innovation: How science, engineering, and industry methods can combine to generate beneficial socioeconomic impacts. *Implementation Science, 7*(1), 44–62.

Thonon, F., Boulkedid, R., Delory, T., Rousseau, S., Saghatchian, M., van Harten, W., O'Neill, C., & Albertu, C. (2015, April 2). Measuring the outcomes of biomedical research: a systematic literature review. *PLoS ONE,* 1–14.

Uttam, S., & Venugopal, P. (2008). Assessment of benefits from sponsored research in publically funded organizations: A semi-empirical model. *Research Management Review, 16*(1), 57–68.

Weiss, A. P. (2007). Measuring the impact of medical research: moving from outputs to outcomes. *The American Journal of Psychiatry, 164*(2), 206–214.

Wheelen, T. L., & Hunter, J. D. (2004). *Strategic management and business policy* (9th ed.). Upper Saddle River, NJ: Pearson/Prentice Hall.

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