Assessing the economic impacts of university R&D and identifying roles for technology transfer officers

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Link, A. N. (2000). Assessing the Economic Impacts of University R&D and Identifying Roles for Technology Transfer Officers. *Industry and Higher Education, 14*(1), 24–32. https://doi.org/10.5367/000000000101294823

Abstract:

The increasing role that universities are playing in supporting national technological infrastructure and the increasing attention that governments are paying towards fiscal responsibility combine to underscore the importance for universities of demonstrating to their stakeholders the impacts of their R&D activities. This paper sets forth guidelines for assessing the economic impacts of university R&D and identifies what may become the roles and responsibilities of technology transfer officers in the assessment process.

Keywords: research and development | economic impact assessment | technology transfer officers

Article:

Two important trends motivate this paper. One is the increasing role that universities play in the USA in supporting the technological infrastructure, and the other is the increasing attention that governments are paying towards fiscal responsibility. Both these trends underscore the importance for universities of demonstrating to their stakeholders the impacts – economic impacts in particular – associated with their research and development activities (R&D); and both trends foreshadow the role that university technology transfer officers will have in the assessment process.

Before discussing these trends, key concepts must be defined, so as to determine the scope of this paper:

- What is a university?
- What is R&D?
- What are economic impacts?

The term ‘university’ refers here to a chartered institution, be it public or private, with an educational mission of creating and distributing knowledge.

'R&D' is somewhat problematic. Many may associate research and development only with innovative inquiries in the hard sciences. This is certainly the type of R&D that is initially thought of when universities are charged with the role of supporting the nation's technology infrastructure. But, university-based research and development is broader than this. R&D is the fundamental process for generating knowledge. As such, it encompasses the scholarly activities of scientists, humanists, and artists, and all related scholarly activities scrutinized by stakeholders. However, the assessment process outlined in this paper may not apply equally well to the scholarly endeavours of each of these members of the academy. It applies most logically to scientists, including social scientists, and to engineers. Hence, a more narrow definition of R&D is used here, one that parallels the definition used by the National Science Foundation for industry reporting purposes:[1] *research* is the advancement of the discovery of scientific knowledge and *development* is the systematic use of such knowledge.

Finally, the term 'economic impacts' refers to the leveraging effects that knowledge, created in and distributed by the university, has on economic activities. The economic impact assessment process discussed here is an *ex post* process; it is not an *ex ante* process designed to guide a university to allocate budgets between project A and project B based on expected economic outcomes. On the contrary, the assessment process takes as given the university's budget allocation process and the research interests of its faculty; that is, this assessment process is not a capital budgeting tool. The process focuses only on a subset of research as well as development activities that lead directly to results that can be mapped to economic outcomes so as to demonstrate to the university's stakeholders, in terms that they are likely to understand, what they are receiving from their research-support dollars. Such fundamental discoveries as quantum theory, relativity, wave mechanics, magnetic resonance, radioactivity, and atomic, nuclear, or molecular structure determination would not have been justified in terms of economic benefits at the time the basic research was conceptualized or even being conducted. But, after the fact – decades later in many cases – economic impacts can readily be quantified.

The views expressed in this paper on assessment processes and on technology transfer officers' roles have evolved over time and are based on personal involvement in designing and implementing economic impact assessment plans of R&D activity both in universities and in federal laboratories throughout the USA as well as in other industrialized nations, and on advising and assessing the related technology transfer activities in each type of organization. The two constants in each of these undertakings are that assessments will be done, be they initiated by the university or by its stakeholders, and that technology transfer officers will be involved to some degree in the process. Therefore, following on this second observation in particular, this paper intends to suggest to university technology transfer officers a roadmap of the possible roles a technology transfer officer may play in the assessment process and thereby to provide a window of opportunity for them to anticipate their own strengths and weaknesses in meeting forthcoming administrative requests.

Background trends

Technology infrastructure

[1] Albert N. Link, 'On the classification of R&D', *Research Policy*, May 1996, pp 379–401.

In 1996, the US Council on Competitiveness, a 'nonpartisan, nonprofit forum of chief executives from the business, university, and labor communities working together to set a national action agenda for US leadership in global markets, technological innovation, and education and training that will raise the standard of living of all Americans',[2] published *Endless Frontiers, Limited Resources: US R&D Policy for Competitiveness.* Therein, the Council takes the position that:[3]

> The US research and development enterprise finds itself in a wrenching period of change with the end of the Cold War, the globalization of the world economy and the drive to eliminate the federal deficit. . . . The US R&D establishment has now entered a pivotal phase of transition – one that will determine our nation's long-term capacity to make and exploit discoveries and innovations in critical areas, while providing world-class institutions, facilities and education in science, mathematics and engineering. As a practical matter, future US economic competitiveness hangs in the balance.

The Council makes clear its position that 'R&D partnerships hold the key to meeting the challenge of transition that our nation now faces'.[4] These partnerships will increasingly rely on universities to ensure the success of the research being undertaken. In fact, according to the Council, universities are being 'viewed by both industry and government as more vital than ever to the nation's future'.[5] As such, there is a trend for private and public sector leaders to look to universities, and especially to their R&D activities, to support the nation's technological infrastructure. Private and public sector leaders will hold universities accountable for their success, and hence the success of their R&D activities, in providing effective infrastructure support.

The following example illustrates by inference the infrastructure role of universities – a role that is expected to increase. The Advanced Technology Program (ATP) in the USA was established within the National Institute of Standards and Technology (NIST) through the *Omnibus Trade and Competitiveness Act of 1988*, and later modified by the *American Technology Preeminence Act of 1991*. The goals of the ATP are to assist US businesses to improve their competitive position and to promote economic growth by accelerating the development of a variety of precompetitive generic technologies by means of grants and cooperative agreements. Since the ATP made its first awards in 1991, approximately 60% of all funded projects involved a university either as a research partner in a research joint venture or as a subcontractor to a research project.[6]

All universities are public

In the USA, there is a clear trend towards increased fiscal accountability. This concept is rooted in the fundamental principles of representation of the people and by the people. However, as a

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[2] Council on Competitiveness, *Endless Frontiers, Limited Resources: US R&D Policy for Competitiveness*, Washington, DC, 1996.
[3] Ibid, p 3.
[4] Ibid, p 3.
[5] Ibid, p 21.
[6] Bronwyn Hall, Albert N. Link and John T. Scott, '*Universities as Partners in ATP-Funded Research Projects*', draft final report submitted to the Advanced Technology Program, National Institute of Standards and Technology, December 1998.

more modern concept, accountability can be traced to the political reforms initiated by President Woodrow Wilson. In response to scandal-ridden state and local governments at the turn of the century, the concept of an impartial bureaucracy took hold in American government. Accountability, neutrality, and expertise became three of Wilson's reform themes. Shortly thereafter, Congress passed the *Budget and Accounting Act of 1921*, which began a modern tradition of fiscal accountability in public institutions.

Building on the general concept of accountability established in the more recent *Competition in Contracting Act of 1984*, the *Chief Financial Officers Act of 1990*, and a variety of state initiatives, the *Government Performance and Results Act (GPRA) of 1993* was passed. The focus of GPRA is performance accountability. The purposes of the GPRA are, among other things, to:

(1) improve the confidence of the American people in the capability of the Federal Government, by systematically holding Federal agencies accountable for achieving program results;
(2) initiate program performance reform with a series of pilot projects in setting program goals, measuring program performance against those goals, and reporting publicly on their progress;
(3) improve Federal program effectiveness and public accountability by promoting a new focus on results, service quality, and customer satisfaction;...

Under the GPRA, all federal agencies, not just mission-driven agencies, were required to submit to the Office of Management and Budget no later than 30 September 1997:

> a strategic plan for program activities [that contains among other things] a description of the program evaluations used in establishing or revising general goals and objectives, with a schedule for future program evaluations,

where 'program evaluation' is defined within GPRA to mean:

> an assessment, through objective measurement and systematic analysis, of the manner and extent to which... programs achieve indented objectives.

The economic implications of these federal initiatives are broad, as discussed by Link and Scott[7] and accordingly a variety of evaluation and assessment programmes will result within federal agencies. Whereas GPRA is limited to federal agencies, some state legislatures have begun to mandate GPRA-like accountability exercises for their own agencies. As this continues, all universities, like federal agencies, may be required to undertake systematic programme evaluations that will by definition require an assessment of university R&D. Youtie, Bozeman, and Shapira[8] illustrate this clearly for the state of Georgia.

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[7] Albert N. Link and John T. Scott. 'Evaluating technology-based public institutions: lessons from the National Institute of Standards and Technology', in G. Papaconstantinou, ed, *Policy Evaluation in Innovation and Technology*, OECD, Paris, January 1998.
[8] Jan Youtie, Barry Bozeman and Philip Shapira, *Assessing Methods for Evaluating State Technology Programs*, final report to the Georgia Research Alliance, April 1997.

The title of this sub-section states that all universities are *public* and the paragraph above posits that, as mandated public accountability trickles back to states, then *all* universities may be required to mirror GPRA-like processes. Certainly, there are public and private universities from the perspective of ownership authority, but as is clearly illustrated by the data in Table 1, all universities are affected in some degree by political authority and hence to some extent all universities are public.[9]

Table 1. Academic R&D by source of funds

	1996		1990	
	Public	**Private**	**Public**	**Private**
Total ($1000)	15,531,711	7,463,752	10,760,820	5,424,502
Federal government (%)	54.2	72.2	52.3	72.7
State and local government (%)	10.1	2.2	11.1	2.4
Industry (%)	6.9	6.9	6.8	7.1
Institution (%)	22.5	9.9	23.3	9.0
Other (%)	6.4	8.9	6.6	8.8

Source: National Science Foundation Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996.

Only two years of data are presented in Table 1, but over the past three decades there have been some noticeable trends. Industry's share and the institution's share of academic R&D have been slowly increasing, while the government's share has been slowly decreasing. For 1996, the percentage of academic R&D funded by federal, state, and local governments at public institutions was 64.3%, compared to 74.4% at private institutions (although the dollar amount allocated to public institutions is nearly twice that of private institutions). As a result of such dependency on public funds, private universities may well be publicly accountable in the same sense as are public universities.

One approach to these assessments, whether federal, state, or institutionally initiated, is to examine economic impacts.

Where the trends lead

Figure 1 illustrates how the above two trends converge such that:

- universities will increasingly face performance evaluation pressures resulting from their growing visibility in the nation's technology infrastructure;
- universities will increasingly be held accountable for their performance.

Not all components of performance evaluation of university R&D involve economic impacts. However, economic impacts should be the focus because they are more directly quantifiable, and so more likely to be seen and understood by the university's stakeholders.

[9] Barry Bozeman, *All Organizations are Public: Bridging Public and Private Organizational Theories*, Jossey-Bass, San Francisco, CA, 1987.

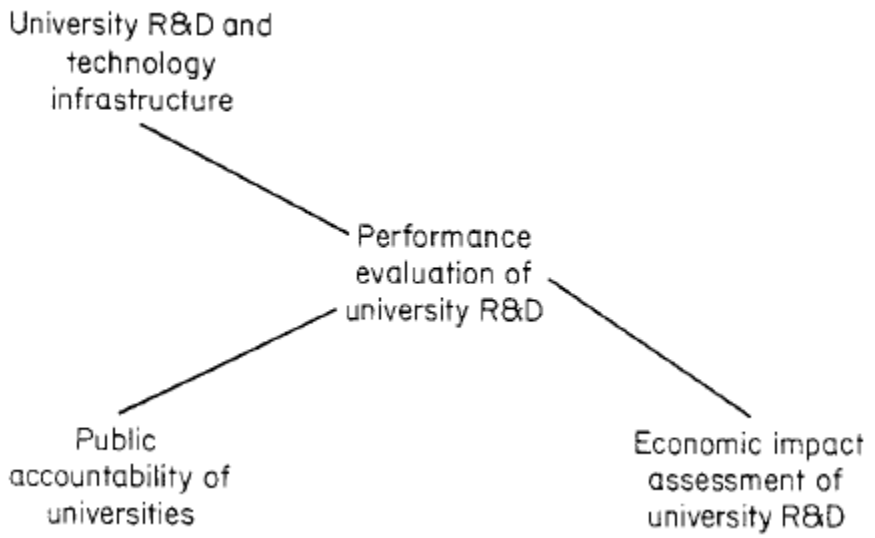

Figure 1. Converging trends and the need to assess economic impacts of university R&D.

Universities have historically, or at least for most of this century, relied on peer review to evaluate the scholarly merits of each faculty member. This is true not only in the USA but also in most industrial nations, as illustrated, for example, by Cooper and Otley[10] for the UK. Few administrators have the breadth or depth of technical or disciplinary knowledge to make such judgments on their own; and peer evaluation is outside the expertise of technology transfer officers. The guidelines set forth in the following section are not a replacement for the peer evaluation, which is critical to the integrity of an institution. However, stakeholders, for the most part, are not interested in the results of peer evaluation. That is the reason why administrators should focus the university's evaluation on the subset of R&D for which economic impacts can be articulated. And it may be the case, as it has been in US federal laboratories, that the university technology transfer officer will be asked either to formulate an 'articulation strategy' for the university or even to become its spokesperson in this area.

The above trends aside, performance evaluations, and economic impact assessments in particular, of university activities are also an effective management tool. Not only is the end result from such evaluations/assessments useful to university administrators, but also the process undertaken can be enlightening in many dimensions, especially those related to strategic planning.[11]

The remainder of this paper focuses on a set of guidelines on how a university should conduct an economic assessment of its R&D activities. From this discussion of guidelines, technology transfer officers may be able to anticipate better their evolving roles in such an assessment process.

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[10] Cary Cooper and David Otley, 'The 1996 Research Assessment Exercise for business and management', *British Journal of Management*, June 1998, pp 73–89.

[11] Albert N. Link, *Economic Impact Assessments: Guidelines for Conducting and Interpreting Assessment Studies*, final report prepared for the National Institute of Standards and Technology, May 1996; Gregory Tassey, 'Lessons learned about the methodology of economic impact studies: the NIST experience', *Evaluation and Program Planning*, Vol 22, 1999, pp 113–119.

Guidelines for assessing economic impacts

The process for assessing the economic impacts of university R&D set forth here is sequential. It has five phases, with multiple stages in certain phases. However, the process is not a mechanical undertaking to be conducted every *n*th year. The process of assessing economic impacts should be continual, in the sense that it is based on gaining pertinent information and then assessing that information. As new information becomes available, it in turn must be assessed.

Others have set forth guidelines for evaluating university R&D *per se*, but this is the first effort to posit that economic impacts are the relevant characteristic of university R&D that stakeholders can understand and embrace. The literature is replete with studies advocating single-dimension evaluation methods that emphasize, for example, counting patents, counting scholarly publications, or counting citations.[12] Furthermore, some scholars take the generalized view that industry seeks technology from universities and evaluates the effectiveness of the technology in terms of its transferability.[13] The importance of an economic impact assessment, such as that set out here, can be inferred from Feller and Roessner's generalizations about the evaluation of science and technology programmes:[14]

> [Our analysis] has implications for current policy and administrative imperatives for performance goals and measurement. These imperatives reflect fundamental expectations [that institutions] that receive public funds be accountable. . . . This proposition has not been at issue. What is at issue, however, are the means and measures by which outcomes . . . are to be evaluated.

The five phases of an economic impact assessment process are:

- information;
- initiation;
- implementation;
- interpretation; and
- iteration.

Information

The information phase of an economic impact assessment involves providing information to university personnel, faculty in particular. Administrators must inform faculty that selected R&D activities of the university will be assessed from an economic impact perspective, and the administration must explain why. It is critical to emphasize to faculty during this information

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[12] Barry Bozeman and Julia Melkers, *Evaluating R&D Impacts: Methods and Practice*, Kluwer Academic, Boston, MA, 1993.
[13] Anthony Bailetti and John Callahan, 'Assessing the impact of university interactions on an R&D organization', *R&D Management*, April 1992, pp 145–158; John P. Gander, 'University/industry research linkages and knowledge transfers: a general equilibrium approach', *Technological Forecasting and Social Change*, April 1987, pp 117–131.
[14] Irwin Feller and David Roessner, 'What does industry expect from university partnerships?', *Issues in Science and Technology*, Fall 1995, pp 80–85.

phase that the assessment process will not only document to the university's stakeholders the economic value of the R&D undertaken within the institution, but will also enhance the managerial effectiveness of the university.

For many faculty the thought of having to explain, much less to justify, to outsiders what takes place within the university requires a cultural change. University administrators will have to understand and embrace this culture change, and then convey its importance to faculty.

Also, administrators will have to dismiss the thought by some faculty that the assessment process is nothing more than a convoluted means for resource reallocation. Those most likely to have such a thought are those most involved in R&D and, thus, the economic impact assessment. Seasoned researchers are sensitive to the fact that extramural support for research has been waning for nearly two decades. Likewise, administrators will have to separate the assessment process from their reallocation agendas.

Finally, administrators will have to assure faculty that not all university R&D can be mapped to economic impacts, and that an economic impact assessment is not a vehicle to sway faculty to conduct more research assessable as such or to undertake more economic-based consulting within the infrastructure of the university. It is not uncommon for faculty to associate the adjective 'economic' with marketability, and marketability with university efforts towards revenue enhancement. Likewise, administrators will have to separate the assessment process from their own biases that it may be in the best interest of the university, or at least selected units, to become more entrepreneurial and commercial with their research activities. And, in relation to this, administrators will have to lose their biases that the only valid assessment vehicle is one that associates faculty outputs with subsequent external revenue inputs.

This information exchange between administrators and faculty may at times be less than a smooth process, due primarily to differing perspectives about both R&D and the assessment process. Table 2 characterizes such potentially abrasive moments in terms of the R&D/administrative expertise of the two groups. As depicted, the most intense discussions are likely to occur between administrators who have bypassed an academic research career and eminent scholars who have similarly skirted administrative assignments. While such discussions are surely undertaken with the best interest of the academy in mind, a natural tension arises from the perception by faculty that administrators have promotion and salary control over faculty and the perception by administrators that faculty can be myopic.

Table 2. Sources of differing viewpoints about the economic assessment process

	Importance of economic assessments	**Appreciation of academic R&D**
Administrators		
followed an administrative path	High	Low
promoted from a successful academic path	Medium	Medium
Faculty		
no administrative experience	Low	High
previous administrative experience	Medium	Medium

Initiation

The initiation phase of an economic impact assessment provides faculty with first-hand experience in participating in the assessment process. One unit or department should be 'objectively' selected for a pilot assessment exercise. The first assessment carried out at a university, including the selection of a unit for the pilot exercise, will be scrutinized by all members of the institution and thus should be an open learning process. The steps for conducting this initiation assessment are the same steps that will eventually be undertaken by all R&D units within the university.

Step 1.

The university must identify its economic stakeholders, in tiers of 'closeness' to the university, and then the unit must similarly identify its economic stakeholders, having learned through demonstration the university's definition of stakeholder.

Why are stakeholders the audience for an economic impact assessment? From a pragmatic perspective, the stakeholders are the people that fund the university and to whom the university is accountable in both a fiscal sense and a performance sense. In other words, the stakeholders represent political authority. While it is the case that knowledge *per se* does enrich society, and education *per se* does provide society with better citizens, stakeholders rarely think in such altruistic terms. Stakeholders are justified in asking – in fact they should ask – 'What are the economic benefits, and how am I better off?'.

For the institution as a whole, its direct stakeholders are those that have made a financial commitment. This group includes taxpayers, directly and through their legislators; contributors; and those who are and who have previously been enrolled. Indirect stakeholders are those whose closeness to the university is measured in terms of their consumption of its outputs. Recall that a university was defined above as a chartered institution, be it public or private, with the educational mission of creating and distributing knowledge. If knowledge, broadly defined, is the output of the university, then those who consume that knowledge are first and foremost students and the community that consumes knowledge-embodied faculty activities; and then, second, and among others, employers who hire students for their knowledge-based capabilities. Obviously, embedded in this concept of closeness is the implicit assumption that a transfer process has occurred.

Identifying an academic unit's stakeholders will generally be less straightforward than identifying the institution's stakeholders. The direct stakeholders include those that are stakeholders in the university, such as departmental majors, and those that directly support the research activities of the unit, such as commercial sponsors of research. Indirect stakeholders such as licensees of particular technology can also be identified. In some universities a portion of income from licences is returned to the research unit from which the technology emanates. Technology transfer officers may draw on their experience and knowledge of transfer activities to assist academic units with this step, in particular to educate academic units about transfer mechanisms and stakeholders' perceptions of them.

Step 2.

The second step in an economic impact assessment is for the unit to identify its outputs, and, as alluded to in the description of Step 1, this Step 2 is in reality a sequential step because identification of indirect stakeholders requires an understanding of outputs. In other words, the unit will have to articulate what it does as well as how what it does translates into observable products, processes, or services.

The GPRA defines an output measure as:

> . . . the tabulation, calculation, or recording of activity or effort [in such a way as] can be expressed in a quantitative or qualitative manner.

It is important to emphasize the use in this GPRA definition of the phrase 'qualitative manner'. While not all of a unit's activities and their associated outputs can be expressed or are expected to be expressed in a quantitative manner, all can be expressed qualitatively.

This process of identifying and articulating outputs also has management value for the university because it forces faculty to think about – even if only in the most general terms – the relationship between the university's resources and the consumers of the outputs of the university's resources. It will be incumbent upon university administrators to emphasize to faculty that there is no implied value judgment being placed on one category of output compared to another. Hence, an invention is not inherently more valuable than a published paper.

From a general perspective, a unit's outputs include teaching, service, and research, as well as quality improvements in each. Regarding teaching, a department's teaching output could be tabulated, calculated, or recorded in terms of number of students taught, number of courses taught, or in terms of value added, meaning the increase in student knowledge (or added value) from an educational experience. Regarding service, a department's faculty could perhaps measure output in terms of university reports or in terms of journal referee reports. While generally not given the same scholarly status as a research paper, they are none the less important and do represent knowledge-based activity. Regarding research or R&D, which is the focus of this paper, selected outputs include published papers, monographs, and books; test methods; inventions; and databases. These realized *ex post* measures are easily quantified.

Step 3.

The third step in a unit's economic impact assessment of R&D is to map its output measures into economic outcomes. What are the economic results associated with a particular output? If, for example, an R&D output is a test method, then the relevant task for the unit is to measure the economic outcomes associated with the test method. Indications of economic outcomes may be revealed by asking: Is the test method being licensed to other universities or companies? If so, how have they benefited?

Not all R&D can be traced into R&D outputs, and not all R&D outputs can be traced into economic outcomes. This is a fundamental characteristic of academic activity and should not be interpreted as negative in any respect. One must, however, search for examples that follow the

R&D → output → outcomes

model so as to assess those activities from an economic perspective. As a simple example of assessable R&D, assume the unit is a physics department and assume its test method output relates to the calibration of optical detectors. Further assume that a stakeholder in the physics department is a company that uses the test method to increase the accuracy of its calibration process and thus increases the accuracy of its product, say a light metre. In this case, the mapping is relatively straightforward:

- Company A underwrites the cost of equipment in the physics department's R&D laboratory.
- The research in the laboratory results in a test method applicable to the calibration of optical detectors, and this test method is published.
- Company A uses the test method in a manner that yields economic benefits.
- Other companies enjoy benefits from the published test method.

As a second example, a faculty member in a civil engineering department develops software for designing expansion bridges. The software package is an output. The university licenses the software, and one licensee is the state's department of transportation. Use of the software not only saves the state millions of dollars in design costs on a new expansion bridge project, but also additional millions of dollars in future repair costs of that bridge and in the design and maintenance of future bridges.

Of all individuals at the university, the technology transfer officers may have the most focused perspective on where such mappings clearly exist in the portfolio of university outputs.

Step 4.

The fourth step in an economic impact assessment of R&D is for the unit to quantify the economic benefits that its direct and indirect stakeholders receive from the economic outcomes associated with the quantified R&D outputs.

'Velleity' means an inclination without the accompanying effort or action. Implementing Step 4 will, without question, bring forth 'velleitious' faculty – that is, those who wish to offer expert opinion about how others should carry out this task, having themselves never made the effort or undertaken the action. As a word of caution, such actions can push the assessment process off course.

Step 4 is what many view as an economic valuation exercise, and, as with any valuation, both art and science are involved. The science of valuation refers to the implementation of a systematic and consistent methodology; the art of valuation refers to the application of informed judgment. Both elements are important.

Step 4 involves a comparison of the actual resource costs of generating the output's outcome with the economic benefits realized by stakeholders. In the example above of the test method developed in the physics department, it is an accounting exercise to associate Company A's financial support to the department with the cost-saving/productivity-enhancing benefits that it receives from using the test method. The fact that other companies in the industry also use the test method may or may not affect the economic benefits that Company A receives. The fact that university resources complement Company A's financial support may not be of interest to Company A, although it will be important to the university for resource management.

In the second example above, of software developed in a civil engineering department, it is also an accounting exercise to determine the state's share of academic support resources devoted to the development of the software, less licensing fees. The harder task is to estimate the economic benefits that the state has received and will receive from access to the state-funds developed software in comparison to the time-weighted probability of access to similar software from an alternative source, such as the private sector.

Step 5.

The fifth step in a unit's economic impact assessment of R&D is for the university to inform the unit's stakeholders and its own stakeholders about the findings from the pilot economic impact assessment. This step should not be interpreted to mean that the only reason for the performance of R&D is to appease stakeholders. There are many spill-over benefits associated with university-based research, as discussed below. However, the primary reason for conducting an economic impact assessment of university R&D is to demonstrate accountability, and the secondary reason is to manage internal resources – to understand the R&D process in order to justify resource allocations across departments or projects.

In addition to informing the unit's and the university's stakeholders about the economic benefits traceable to the unit's R&D, the administration must also inform the academy of the findings and demonstrate that the overall institution is better off for having completed the assessment exercise. Being 'better off' has multiple dimensions, one of which could be the involvement of faculty from the pilot unit in the monitoring of the broader university assessment exercise. Another dimension that will demonstrate to faculty that the institution is internally better off from the assessment exercise is an explicit acknowledgment that not all R&D outputs can be mapped into economic outcomes, but that such R&D endeavours are still very important to the academic well-being of the academy. But the most convincing indicator – perhaps especially to faculty – of the institution being better off is additional resources coming into the university from the university's stakeholders.

Implementation

The implementation phase of an economic impact assessment involves internalizing the economic impact assessment guidelines formulated from the pilot assessment exercise. This will need to be done carefully by the administration, and in a way that develops internal support for the merit of the process.

Interpretation

The interpretation phase of an economic impact assessment involves explaining the findings from the university's assessment process to its stakeholders. When doing so, administrators will have to emphasize the purpose of the assessment process as well as the conservative nature of the economic impacts being reported, as only a fraction of the total academic R&D outputs are included in this stage of the assessment process. This interpretation will require the university to standardize on certain evaluation metrics, especially when providing such information to a state legislature that is, in all likelihood, unfamiliar with evaluation metrics. The metrics should be clearly articulated and well documented. One that is widely understood is a cost–benefit ratio: for example, the ratio of economic benefits to the state and its taxpayers divided by the tax revenues to the university to generate those benefits. The technology transfer officer may not only be involved in maintaining an evaluation metric database, but also may need to assume the role of interpreting the data to those both inside and outside the university.

The university should continually inform the members of the academy of all laudatory feedback that it receives from its stakeholders as they learn about the return that they are receiving on their investments in the institution. Such feedback might take various forms, ranging from the obvious one of increased industrial donations, to the less expected one of increased public moneys in response to good stewardship. Likewise, negative feedback is important because it indicates an important stakeholder reaction to the economic assessment. The negative reaction may be valid, and in that case the university should re-think its mission; or it may be invalid, which should lead the university to rethink its mode of articulating economic impacts.

Recently, the National Association of State Universities and Land-Grant Colleges published the findings from a membership survey that requested data on each university's economic impact on its state and local communities.[15] The specific survey question asked was:

> For every $1 your state invests in your institution, how much total spending is generated in your state's economy?

The Association should be credited for its wisdom in challenging universities to think in such an important dimension. But its lack of methodological guidance, the vastness (and hence vagueness) of its implied definition of economic impacts, and the inexperience of many institutions in thinking of economic impacts in general, much less in the view suggested by the Association, may have created a host of unanticipated problems. Invidious comparisons of responses are waiting to happen.

Iteration

Each subsequent economic impact assessment should be more encompassing than the one before. This is expected as faculty learn by doing, and as administrators learn how stakeholders react to assessment information. Faculty and administration will find over time that assessment

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[15] *Value Added: The Economic Impact of Public Universities*, National Association of State Universities and Land-Grant Colleges, Washington, DC, 1997.

of R&D becomes part of the university's culture, and as it does, the iteration phase is begun. As the iteration phase starts, technology transfer officers may be called upon to take on yet another responsibility, namely documenting the evaluation processes and monitoring them for consistency.

Concluding observations

Table 3 briefly summarizes the scope of each of the five phases of an economic impact assessment of academic R&D. There are three important points to note about the assessment process. First, it is not a totally objective process in the sense that there is informed judgment being invoked by the university. Judgments range from what is and what is not R&D to how best to describe and quantify the economic outcomes from a set of R&D outputs. But who is better equipped than the university to make such judgments? When a university initiates an assessment, it exhibits leadership and awareness of its accountability. Then, it indemnifies itself to some degree from stakeholders making uninformed judgments.

Table 3. Overview of the phases of an economic impact assessment

Phase	
Information	Academy learns about economic impact assessments.
Initiation	Pilot economic impact assessment conducted.
Implementation	Economic impact assessments conducted throughout the university
Interpretation	Metrics relating quantifiable R&D outcomes to stakeholders' resources disclosed.
Iteration	Economic impact assessment becomes a part of the university's culture.

Second, the economic impact assessment process is not an encompassing process. Only selected R&D activities are being considered. Those activities not considered are not less important to the academic mission of the university; rather, they are just different activities. The activities considered are those with observed quantifiable outputs that can be mapped into specific economic outcomes.

Third and finally, no assessment process can capture, much less quantify, all of the intangible benefits associated with academic R&D. Spill-over benefits within the institution include such phenomena as one unit's research outcomes influencing another unit's research outputs or one unit's research outcomes generating a halo effect on another unit's extramural funding proposal. Still, the process set forth in this paper, in all of its narrowness, has the benefit that it can be understood and implemented. Spill-over benefits outside the institution include the success of graduates, or at least the demonstrated value-added for graduates. Yet when administrators are asked 'But *how* do you know this R&D is important?', they must not find themselves either dissembling or simply telling success stories. Through an economic impact assessment they will have conservatively collected information and systematically constructed metrics related to an important subset of their academic R&D. This information and these metrics will be sufficient for an informed response to questions about performance accountability.

Important possible roles for technology transfer officers have been noted herein within the broader context of guidelines for conducting economic assessments. Perhaps more important than simply noting possible roles for technology transfer officers is the charge for this group of individuals to begin to anticipate the form that assessment processes are likely to take at their

own institutions, the many ways they may be called upon to participate in the assessment processes, and the human capital as well as financial resources that will be needed.

This paper has benefited from comments and suggestions of William Little of the General Administration of the University of North Carolina, Barry Bozeman of the School of Public Policy at Georgia Institute of Technology, Irving Feller of the Institute for Policy Research and Evaluation at The Pennsylvania State University, my colleague Dennis Leyden, and Katherine Chapman and other members of the editorial board of the *AUTM Journal*. All remaining shortcomings are my own.