

ACADEMIC WORKFORCE

Innovation, entrepreneurship, promotion, and tenure

Academic incentives must reward broader societal impacts

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Academic promotion and tenure (P&T) processes that typically prioritize faculty grants and publications can fail to fully assess and value entrepreneurial, innovative endeavors (1) that can produce the kind of societal impacts that universities are increasingly being called upon to provide, and that faculty and students increasingly prioritize (2,3). A more inclusive assessment of scholarship and creative activity to better recognize and reward innovation and entrepreneurship (I&E) will require “broadening the bar” (4) to reflect evolving forms of faculty impact without diluting or increasing the requirements for advancement. Expanding what we value as scholarship can also help expand who we value as scholars, and thus support a more innovative and diverse professoriate. We highlight work by the Promotion & Tenure Innovation & Entrepreneurship (PTIE) coalition to promote policies and practices to recognize the impact of faculty I&E. We posit that this strategy can be broadly applicable (beyond I&E) to recognize the many and evolving dimensions along which faculty create societal impacts.

Benefits of I&E efforts by faculty can include “increased opportunities for research funding, access to unrestricted funds for further institutional investment, sustaining high scholarship level, student success, increased prestige, public benefit, and economic development.” (8) In academe, basic research is still privileged (9,10) and processes and policies that reward faculty members’ I&E work are not equally valued, including at research (R1 & R2) universities (8). In addition, I&E should be viewed as broadly inclusive of

the science, technology, engineering, math & medicine (STEMM) disciplines as well as liberal arts and other areas of focus across campuses.

Reform of higher education’s deeply embedded reward structure requires an approach that addresses longstanding norms and organizational cultures (5) as well as the multi-institutional nature of the faculty review process (P&T review typically includes input from external reviewers). Consequently, coordination across multiple institutions is needed to provide a fair and robust review of a given faculty candidate’s contributions and to mitigate potentially limited or biased views of their accomplishments (11). For this transformation to occur, there must be intentionality, leadership, and commitment to both improving the inclusivity and equity in the process as well as incorporating recognition criteria for faculty who engage in evolving forms of scholarship.

The convergence of increased investment in I&E from funding agencies and universities, coupled with an amplified awareness of bias and the need for a more inclusive academy, have opened doors and minds to addressing the longstanding, often-challenging topic of P&T reform. This breadth of engagement across the academy will, we believe, enable the majority of faculty to see benefits to the recommended changes without undermining basic and/or curiosity-driven research and while supporting academic freedom.

SCALABLE SOLUTIONS

An exploratory survey of university administrators and faculty (12) suggested that structures for evaluation of faculty’s I&E impact in considerations of P&T are warranted, but are largely absent at the department, college and central administration levels. For example, faculty across multiple institution types with varying expectations for P&T noted that they struggled to meaningfully evaluate I&E in P&T considerations and typically did not receive any training for conducting these evaluations.

Recognizing the integrated, multi-institutional nature of peer review in the P&T process, the PTIE coalition, with membership from over 65 universities and numerous

stakeholder organizations, is collaborating to develop scalable solutions around a shared goal of improving assessment of I&E in P&T. Input has been gathered through conversations and structured group discussions from a broad cross-section of groups and individuals with a range of roles on university campuses. The aim was to inform best practices and coalesce around consensus recommendations without the requirement to pre-emptively commit to adopting the findings. This enabled successes to be captured and adjustments to be made based on lessons learned from individual member campuses. These conversations surfaced a consistent theme: participants see a critical need for a coordinated effort for inclusively recognizing I&E to enable institutions to share the challenges they encountered attempting to effect change and support shared solutions. Recognizing that some institutions that have had success in this area have done so in part due to deeply embedded innovation cultures and resources that may not exist at most institutions, coalition members thus focused on more general, scalable approaches. True change will take time to realize (5-10 years minimum) and guideline changes alone will not be successful. Consequently, the coalition focused on holistic, multi-dimensional solutions that target expanding the culture on campus to be more inclusive of I&E. Coalition members agreed to take recommendations back to their home institutions to consider, and possibly, implement.

The resulting PTIE coalition recommendations contain four core elements needed to initiate changes that could meaningfully and inclusively account for I&E (see the table). The coalition concluded that the comprehensive approach outlined in the recommendations needed to include each of these four key elements, as solely changing the written P&T guidelines had limited effectiveness on PTIE member campuses. Without concurrent process changes to minimize bias during the review, no incentive is present for those who have been successful under the existing paradigm to support change. Those individuals who are not fully

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1 valued under the current paradigm will
2 either leave the academy or continue to have
3 their accomplishments discounted as
4 compared to their peers.

5 Key aspects of these findings came from
6 existing successes on PTIE coalition member
7 campuses. For example, the suggested
8 university-wide language and sample college-
9 level language builds on wording used at Texas
10 A&M University and Arizona State University
11 respectively that many coalition members
12 believe to have been successful. This
13 recommended university language is critical
14 for linking the evaluation of a faculty
15 candidate's accomplishments with the mission
16 and priorities of the university. PTIE coalition
17 members consistently emphasized the
18 importance of having this connection and its
19 absence in most P&T review processes
20 currently. The U.S. National Science
21 Foundation has helped promote the
22 expectation that applicants for and recipients
23 of federal funding demonstrate impact to the
24 public through its broader impact review
25 criterion. Consequently, faculty should be able
26 to connect their research, agnostic of whether
27 it is basic or applied, to boarder impacts that
28 align with the institutional mission. In addition,
29 this linkage provides a key pathway for
30 recognition of other areas of scholarship not
31 currently valued fully under the existing
32 evaluation structure but aligned within the
33 university's priorities.

34 The PTIE coalition suggested six sub-
35 categories of suggested metrics, with specific
36 examples provided within each category –
37 including wording to provide inclusive
38 recognition of I&E impacts beyond the STEM
39 disciplines [e.g. "installation of creative works,
40 commissioned works" as examples of
41 intellectual property and "startup/spinout
42 organizations (including for-profit, non-profits
43 and foundations to allow for broad recognition
44 of societal impact)" within the entity creation
45 sub-category]. Sample text within the
46 evaluation criterion for scholarship & creative
47 activity ensures that continued importance
48 must be placed on peer review while including
49 the opportunity to demonstrate impact to the
50 public: Scholarship & creative activity are
51 "based on a high level of professional
52 expertise; must give evidence of originality;
53 must be documented and validated as through
54 peer review, critique or validation by evidence
55 of societal or disciplinary usage/benefit; and
56 must be communicated in appropriate ways so
57 as to demonstrate significant impact for the
58 public and/or for the discipline itself (including
59 future impact as appropriate)."

Recommended process changes also
benefited from the shared experiences of

coalition members. For example, Oregon State
University's experience with the Search
Advocate program, which is used on dozens of
campuses nationally to address implicit and
explicit bias in the hiring process, informed the
recommendation of process consultants.
Considerable emphasis was placed on
addressing bias in the review process to ensure
that all faculty will benefit from the
recommended changes through a more
transparent process that addresses bias and
reduces the potential for individuals in the P&T
review process to improperly influence the
outcome without accountability or for reasons
outside of the established parameters. In
addition, the recommended process changes
amplify this dialogue about bias and holistic
assessment through recommendations to
provide a detailed letter of instruction for
external reviewers, improve the clarity and
structure of the personal statement provided
by the candidate, and implementation of
training on evaluating I&E outputs for faculty.

The coalition's recommendations are not
intended to supplant or dilute the research,
teaching and service categories traditionally
evaluated on university campuses. Instead,
they suggest how to systematically measure
and value faculty I&E impact as integrated
within the teaching, research, and service
categories. Faculty fully valued under the
existing promotion and advancement structure
must not be negatively impacted by this more
inclusive approach to valuing faculty's diverse
forms of scholarship. Instead, the focus of PTIE
is on broadening the opportunities for
recognizing impact within a common structure
that does not dilute or augment the overall
requirements for promotion.

SUPERSTRUCTURE FOR EVOLVING FORMS OF IMPACT

I&E represents an example of the many
evolving forms of scholarship for the 21st-
century faculty member. But I&E is a scholarly
path – along with diversity, equity & inclusion
(DEI), interdisciplinary team science, open
science, community engagement and others –
that can be overlooked or undervalued in the
process by which universities review, reward
and advance the academic workforce (5,6,7).
As these evolutions are incorporated into the
fabric of higher education, the faculty
evaluation process thus needs to be updated
to reflect this changing landscape.

Building on a view that expands the
traditional definition of scholarship and
research into discovery, integration,
application and teaching (13), we suggest
that the evaluation framework proposed by
the PTIE coalition can extend beyond I&E to

support evaluation of a variety of faculty
impacts. In particular, the current omission
of university-wide language and much
needed process changes in existing P&T
practices (see Table 1) hinders reforms to
reward and advancement across many
domains of scholarship and creative activity.
Incorporation of these two elements
(university-wide language and process
changes) into the fabric of a university will
support a more dynamic and inclusive
ecosystem in which faculty can contribute
and meet the mission and priorities of the
university without damaging the core
principle of any university to support the
pursuit of knowledge.

The diverse and evolving forms of
scholarship can often be viewed as an
impediment to establishing a uniform
structure for evaluation of a dossier for
promotion and tenure. Instead of viewing
these differences as barriers, we suggest that
a common set of priorities already exists for
building the appropriate criterion of a given
type of scholarship: (a) support the
university mission, (b) address an identified
need by stakeholders (e.g., funding agencies,
foundations, professional societies,
employers, students, alumni, local, state
and/or federal organizations and/or others)
, (c) embody a priority of the institution, (d)
the institutional process must contain
necessary processes, procedures, and
cultural elements which support an unbiased
evaluation and (e) the institution must
provide language that links the priorities,
need and mission to the evaluation process.
With this architecture identified, faculty
engaged in diverse and novel forms of
scholarship can benefit from a shared
roadmap for facilitating systems-level
change. Additionally, this superstructure
provides a mechanism for collaboration
amongst otherwise disconnected areas of
focus on campus that will collectively impact
the majority of university faculty and
increase the likelihood for adoption within
the university.

Recognizing the persistence of bias,
whether it be the candidate's research topic
or their ethnicity, gender, sexual orientation
and/or other diverse backgrounds, in the
current process is essential to improving
fairness and validity in the future of review
and advancement. Consequently, the PTIE
coalition recognized the overarching
importance and intersection of DEI with I&E
and embedded that thinking throughout
development of the recommendations
(including the explicit inclusion of minority-
serving institution perspectives in the

coalition conversations). Full acknowledgement that faculty members from diverse backgrounds engage in diverse forms of scholarly activity is essential to any productive discussion about change. This reality – that underrepresented faculty often face compounded bias on the basis of both their social identity group and their approach to scholarship – points to the need to update P&T processes to ensure the equitable evaluation of faculty impact. Many current P&T policies, practices and cultures were rooted in eras when the academy was more homogenous and less focused on creation of an inclusive environment that can evolve to meet the needs of a changing academy and student population.

Adjustment of the P&T guidelines alone is unlikely to facilitate the culture shift needed to see transformative change in non-traditional forms of scholarship are valued (including I&E) and inequities are addressed. For example, reviewers bring with them both explicit and implicit biases to their evaluation of a candidate (14). Consequently, the PTIE coalition recommends a broad collection of process changes to start to address implicit and explicit bias within the review process including expanded training and external reviewer resources. These improvements would benefit the entire academy – not just I&E-focused faculty – by supporting a more diverse academic workforce to engage in novel forms of scholarship.

The recommendations of the PTIE coalitions enables inclusion and recognition of a diverse cross-section of university faculty that extends well beyond the patent/licensing/startup paradigm to include entrepreneurial efforts such as social innovation, the creation and/or engagement of non-profits, foundations and other organizations, as well as I&E-related curricular developments and student mentorship. In addition, explicit discussion of aligning priorities between the faculty member and the university around their I&E efforts (traditionally referred to as conflict-of-interest management) is essential to address the financial aspects of some forms of I&E impact and ensure that the pursuit of knowledge is not motivated by financial gain. Universities should be also wary of pursuing I&E solely as a potential new revenue stream from technology transfers agreements, as often this is not the case(15). Rather, I&E should be viewed as an essential component of realizing the institution's mission to society.

The higher education workforce and

academia landscape are changing on a global scale. There is growing concern that the traditional systems that anchor institutions, including promotion and tenure practices, may no longer sufficiently support those very institutions to live up to their social contract with civic society. Groups including funders and academic associations are broadly addressing the need to modernize how we recruit, retain, and reward the academic workforce. Especially apparent in this time of awakening about systemic inequities and exclusion, universities should be leading the way by improving their own practices and making room for faculty to realize institutional ambitions to serve society. This necessitates both a bottom-up interest from faculty and a top-down commitment from university leadership.

REFERENCES AND NOTES

- 1.J. Bouwma-Gearhart, R. Carter, K. Mundorff, *Change: The Magazine of Higher Learning*, 53, 18-24 (2021). <https://doi.org/10.1080/00091383.2021.1883973>
- 2.H. C. Clark, C. T. Blackwell, K. Murri, D. Overton, V. Nijhawan, S. Ingram, "The Innovation Impact of US Universities: Rankings and Policy Conclusions." June 2020. <https://gwbcenrter.imgix.net/Publications/Resour ces/gwbi-university-impact-report-ranks-exec- summary-full-report.pdf>
- 3.S. Mintz, *Why Higher Education Will Change*. Inside Higher Ed., October 3, 2019. <https://www.insidehighered.com/blogs/higher-ed-gamma/why-higher-education-will-change>
- .National Academies of Science, Engineering, and Medicine. 2020. *Re-envisioning Promotion and Advancement for STEM Faculty: Proceedings of a Workshop—in Brief*. Washington, DC: The National Academies Press. DOI: <https://doi.org/10.17226/25742>
- 5.O'Meara, K. (2010). *Rewarding Multiple Forms of Scholarship: Promotion and Tenure*. In Fitzgerald H., Burack C., & Seifer S. (Eds.), *Handbook of Engaged Scholarship: Contemporary Landscapes, Future Directions: Volume 1: Institutional Change* (pp. 271-294). Michigan State University Press. <http://www.jstor.org/stable/10.14321/j.ctt7ztb0c.22>
- 6.K. A. O'Meara, L. Sandmann, J. Saltmarsh, D. Giles, *Innovative Higher Education*, 36, 83-96 (2011). <https://doi.org/10.1007/s10755-010-9159-3>
- 7.J. T. Klein, H. J. Falk-Krzesinski *Research Policy*, 46, 1055-1061 (2017). <https://doi.org/10.1016/j.respol.2017.03.001>
- 8.P. R. Sanberg, M. Gharib, P. T. Harker, E. W. Kaler, R. B. Marchase, T. D. Sands, N. Arshadi, S. Sarkar, *Proc. Natl. Acad. Sci. U.S.A.*, 111, 6542-6547 (2014). <https://doi.org/10.1073/pnas.1404094111>
- 9.M. S. Anderson, E. A. Ronning, R. D. Vries, B. C. Martinson, *The Journal of Higher Education* 81, 366-393 (2010). <https://doi.org/10.1080/00221546.2010.11779057>
- 10.P. Mendoza , S. D. Ocal , Z. Wang, E. Zhou, *Faculty norms and university/industry linkages in STEMM*. *Studies in Higher Education* 45, 1474-1487 (2020). <https://doi.org/10.1080/03075079.2018.1541451>
- 11.J. Genshaft, J. Wickert, B. Gray-Little, K. Hanson, R. Marchase, P. E. Schiffer, R. M. Tanner, *Technology*

& *Innovation*, 17, 197-204 (2016). <https://doi.org/10.3727/194982416X14520374943103>

- 12.J. Bouwma-Gearhart, C. Lenhart, R. Carter, K. Mundorff, H. Cho, J. Knoch, J. Open Innov. Technol. Mark. Complex. 7, 182 (2021). <https://doi.org/10.3390/joitmc7030182>
- 13.E. L. Boyer, D. Moser, T. C. Ream, J. M. Braxton, *Scholarship Reconsidered: Priorities of the Professoriate*. San Francisco, CA: Jossey-Bass. (2015)
- 14.J. L. Cundiff, C. L. Danube, M. J. Zawadzki, S. A. Shields, *J. Higher Ed.* 89, 611-6136 (2018). <https://doi.org/10.1080/00221546.2018.1437665>
- 15.J. Marcus. "Think universities are making lots of money from inventions? Think again." *Hechinger Report*, January 17, 2020. <https://hechingerreport.org/think-universities-are-making-lots-of-money-from-inventions-think-again/>

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Supplementary Materials
URL

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Four Core Elements of PTIE Recommendations. These core elements are also intended to provide a framework for concurrent efforts to reimagine other areas of scholarship in promotion and advancement.

University-Wide Language directly linking the evaluation of faculty to institutional mission, values & goals across the multiple levels at an institution (unit, department, school, college, university, system). Sample Text: "XYZ University promotes economic, societal, cultural and environmental progress for the people of XYZ, the Nation and the world through producing graduates competitive in the global economy, supporting a continuous search for new knowledge and solutions and maintaining a rigorous focus on academic excellence. Evaluation of faculty for promotion and/or tenure includes their contributions to the institution's mission and stated priorities. Evidence for broader (societal) significance of the work, either now or in the near future, should be included within their personal statement and/or other appropriate portions of their dossier."

I&E Metrics to serve as indicator data to be used in a narrative thesis of impact. Metrics are grouped into six sub-categories: intellectual property, sponsored research, use & licensing, entity creation, I&E career preparation and I&E engagement.

I&E Text for Evaluation Criterion to be incorporated into the (a) research (scholarship & creative activity), (b) teaching & advising and (c) service categories typically evaluated for P&T.

Process Changes for supporting systemic culture change, improving transparency and

1 addressing bias (e.g., directions for personal
2 statement, external reviewer resource and
3 guidance, involvement of P&T process
4 consultants, expanded training, reframing &
5 importance of DEI).
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