Workshop on the Implications of Convergence for How the
National Center for Science and Engineering Statistics Measures the
Science and Engineering Workforce

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Remarks by
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Thank you Barbara.

This has been a truly excellent workshop. I started to think about Convergence in 2013 soon after I joined NSF as Assistant Director and head of the Engineering Directorate. So not quite from the very beginning at MIT but soon thereafter. I think this workshop was the most sophisticated discussion of convergence, certainly as a concept. The focus on the measurement question actually led to a much deeper and nuanced discussion of convergence. We can be very pleased and proud of this workshop. For this, I thank the workshop presenters and participants, NASEM staff, specifically Kristizna Marton, our Chair Barbara Entwisle and fellow steering committee members. It has been an honor and pleasure to be on this team.

Framing definition of convergence: deep integration of knowledge bases, tools, techniques, and ways of thinking from multiple disciplines as a novel method for producing new knowledge that is particularly suited for solving complex problems of societal interest.

As Ben Jones mentioned, the demand for such knowledge is immense. The bottleneck is on the supply side as the numbers of combinations are exponentially large and therefore require very large resources since we do not a priori know what will be truly successful.

We heard throughout the workshop that convergence is a multidimensional and multifaceted concept and phenomenon. In this regard, I find the ecological framework proposed by Dan Stokols very compelling. We must keep this in mind as we think about the key questions posed to us by NSF. Given this ecological view, it is clear that all the stakeholders have important roles in the convergence model of knowledge creation. And their actions can help facilitate progress on and measurements of convergence.

We heard many ideas from our presenters. They ranged from the level of granularity at which such measurements might be made to various types of tagging, labeling, analysis, and the full life-cycle of research, from ideation to proposals to projects to products to impacts of research. Time is too short to go into details of these issues.

With that, I will turn to some observations and conclusions although I must add that my thinking will certainly evolve as I digest the presentations and discussions over the last two days.

A single measure at the national level is neither likely to be useful nor work. I am no expert on surveys or measurements, but I feel that we are likely not be ready for a single measure. We need to look for multiple indicators as well as maps and other forms of depiction of convergence. We also need to keep quantitative and qualitative aspects of convergence in mind. There appear to be some tools that are at various stages of development and maturity that have great potential for our ability to map convergence. NSF should take suitable actions to further support these developments and enable access to these tools to the research community and other stakeholders.

Beyond NSF and federal government agencies, research institutions, research centers, and individual researchers could derive large benefit from such tools. I would hope that the entire research community becomes more familiar with these tools and use them to improve all aspects of research processes. Also, as these tools become increasingly used in universities, the survey based tools that NCSES uses could become more informative.

If we accept the problem solving framework for convergence, then it seems logical that mission agencies such as Dept of Energy, NIH, NASA, NOAA, Dept of Defense, EPA and others would have the responsibility and resources for addressing key problems of societal interest. NSF could take a leadership role in advancing the use of convergence framework and the measurement tools discussed in our workshop at the mission agencies. As a pilot program, perhaps some key problem areas could be identified where these tools could be put to use and see if they shed new light on trajectories of progress.

I am very supportive of the work on measuring convergence that NCSES has already done and is working on. From workforce viewpoint, I believe better tools for measuring convergence in PhD graduates is critical. This is related to the Survey of Doctorate Research. In this regard, we need to address several important issues. Given that a PhD dissertation is associated with one individual, how would we assess convergence? Could it be through the publications that emerged from it? Or could it be through the diversity of the dissertation committee? How do we assess the intellectual, emotional and social components that are critical for convergent research teams vis-à-vis the preparation and training of the PhD graduate?

Would it be useful for NCSES to work with the Graduate Education Division at NSF for a national dialog on metadata on PhD dissertations that might capture such indicators?

In a different direction, could NCSES partner with other Directorates and Divisions at NSF that might be interested in measuring convergence in their research programs and funded researchers?

How can NSF (and NCSES) work with industry on the measures and maps of convergence? I know at NSF is thinking about public-private partnerships. Could convergence measurements and maps be useful for such partnerships?

NCSES should consider how the tools that were presented in this workshop could become more ubiquitous in the NCSES reports and publications, both print and online. I think it is possible NSB discussions and NSB members will find the portfolio level maps very compelling and interesting.

Thank you Barbara.