The Life Sciences Entrepreneurial Piece of the New Jersey STEM Puzzle

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The article addresses the Life Sciences piece of the larger STEM enterprise, that has its own sub-diversity of high and low performers. The article will be followed by additional articles & interviews with key stakeholders in the New Jersey Life Sciences and Pharmaceutical sectors and their recommendations for reviving the declining growth.

"New Jersey has more scientists and engineers per square mile than anywhere in the world", anecdotal evidence, currently inadequate to propel New Jersey to the top of life sciences clusters list (Fig.1). The pharmaceutical/life sciences sector has developed into one of New Jersey's leading economic engines. Headquarters or major facilities for 13 of the largest pharmaceutical/life sciences companies, availability of highly skilled workforce along with world-class universities and teaching hospitals have helped make the state a hub for the pharmaceutical/life sciences sector (1). According to a recent U.S. Bureau of Labor Statistics report, NJ ranks 4th highest state for life sciences employment level and 5th highest for concentration of jobs and location quotients in life sciences (1,2).

Figure 1. U.S. cluster rankings. Adapted from (1).

Unfortunately, despite New Jersey's drug & pharmaceutical industry overall growth by +10.5%, the life sciences industry has experienced a steady decline. It declined 13.7% from 2007 to 2013, flattened out from 2013 to 2014, increased marginally between 2014 to 2016 (+1.58%) and currently at -11.2%, is below the 2006 employment level (3, Fig.2). New Jersey therefore has a huge population of skilled workforce that has either lost employment due to the down-sizing observed in the field or been forced to accept jobs that do not require their level of training.

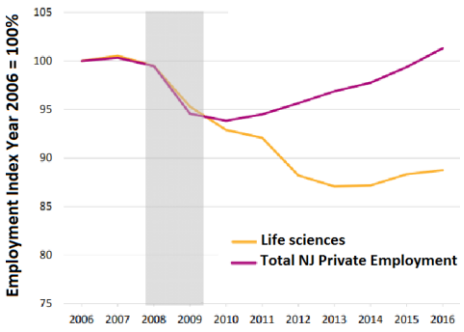

Fig. 2. N.J. Life Sciences Industry Cluster Employment Index. Adapted from (3).

The trend is also observed nationally. A 2017 Bureau of Labor Statistics (BLS) report reveals that the U.S. had nearly 8.6 million STEM jobs as of 2015 and it will add more than 2.6 million STEM jobs between 2014 to 2024 (4). While the STEM enterprise is growing, studies from industry leaders like Harold Varmus are also simultaneously reporting surplus production of STEM workforce in some fields like the Life Sciences, Physical Sciences and Chemical Sciences, leading to high rates of unemployment (3,5). Adding to the complexity is the level of education required to meet the future STEM job market demands. While 73% of STEM occupations will require a bachelor's degree for entry, doctoral or professional degrees will be required for less than 4% of STEM jobs (5). There seems to be an obvious disproportionality in supply and demand, at least for Life Sciences PhDs, many more being produced than required by the CURRENT job market.

These trends are stoking discussions about decreasing the production of PhDs in biomedical fields. The lower employment prospects for future scientists would normally be expected to lead to a decline in graduate school applicants, as well as to a contraction of the life science market short-mid-term (6). But **is reducing the number of doctoral candidates in life sciences the right solution?** Certainly not, because that would equate to U.S. doing away with the rich history of scientific excellence and predominance it has built over the past centuries.

So, what is the right solution going forward? The Computer Science PhD entrepreneur from Rice University seems to have hit the nail in the head in this article (7). As stated by Mohit Aron PhD, founder of Nutanix and Cohesity: "*What did I gain from doing a Ph.D.? I realized that I had learned a way to invent knowledge, not just acquire knowledge -which you can get from reading books". He further elaborates:*" ***What a Ph.D. really does is teach you to identify the right problem, find the right solution and learn the art of communicating your solution to the world. And you complete the sequence at a fast pace because you have to do it over and over to get your Ph.D.".***

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Does that ring a bell? Ph.D. students have been trained to innovate and invent. With the current focus and resources available to ignite entrepreneurship and availability of surplus, trained workforce to lead such ventures, it certainly makes sense to allow this workforce to get a chance to create innovative ventures. In addition to gainful engagement of current stakeholders, such entrepreneurial innovation will open employment opportunities for future scientists as well as create opportunities for other support roles. This will ultimately lead to an economy boost at New Jersey, as well as national level and help in upholding U.S. as a Life Science /STEM world leader. **True solution lies in creating additional opportunities that utilize the skilled workforce we have invested in to stimulate innovation in the industry.** The current job projections are not sufficient to support the growing enterprise.

What is New Jersey state doing to support such innovation? After the closure of **New Jersey Commission on Science and Technology** in 2010, not much has been invested by the State into this sector. Other State's that have invested in life sciences through partnerships with local governments and institutions, have evolved into top life science clusters with potential to divert New Jersey's human and other capital. **New Jersey needs to adopt pioneering legislations and other strategic initiatives to re-invigorate its ecosystem and to retain the competitive edge.**

A comprehensive "STEM" growth strategy needs to address 5 major focus areas highlighted in the fig. 3, based on fundamental of growth via job creation. To ensure production of the right STEM talent aligned with market requirements, a close association of the academic Institutions and the STEM industry is critical. Beyond alignment with the current market requirements the academic curriculum should be updated frequently to evolve with changing market requirements. Misalignment in gauging the market requirements by the academia has previously led to and will continue to lead to an unbalanced supply /demand situation.

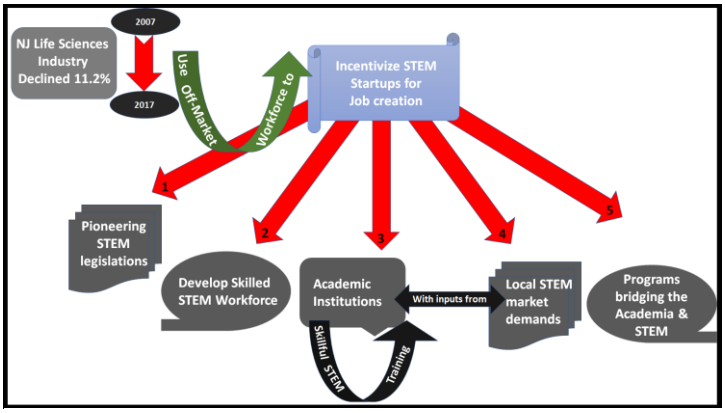

Fig. 3. Five major focus areas for a comprehensive "STEM" & Life Sciences growth in N.J.

The New Jersey chapter of Association for Women in Science recently initiated Entrepreneurship and Innovation challenges to encourage females with STEM training to flex their entrepreneurship muscles. Once again, the New Jersey Pharmaceutical industry stepped up to support these initiatives. With more than 100 years of innovation history, New Jersey has been a key player in the sector and with continued support and interactive solutions from the government, academic institutions, Pharmaceutical & Biotechnology companies, New Jersey has the potential to re-emerge as a leader.

REFERENCES:

1. JLL research (2017). An evolving industry: Today's clusters creating tomorrow's breakthroughs. U.S. Life Sciences Outlook. http://www.us.jll.com/united-states/en-us/Research/JLL-US-Life-Sciences-Outlook-2017.pdf?e89ae5d2-1063-4ad2-b303-bac0a93f4f1f
2. 2016 Occupational Employment Statistics, 9-1099 Life Scientists, All Other. U.S. Bureau of Labor Statistics. https://www.bls.gov/oes/current/oes191099.htm
3. New Jersey's Life Sciences Industry Cluster (2017). Prepared by: New Jersey Department of Labor & Workforce Development Office of Research & Information Bureau of Labor Market Information. https://lwd.state.nj.us/labor/lpa/pub/empecon/biopharma.pdf
4. Stella Fayer, Alan Lacey and Audrey Watson (2017). STEM Occupations: Past, Present, And Future. U.S. Bureau of Labor Statistics. https://www.bls.gov/spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/pdf/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future.pdf
5. Bruce Albertsa, Marc W. Kirschnerb, Shirley Tilghmanc and Harold Varmus (2014) Rescuing US biomedical research from its systemic flaws. PNASc, 111 (16) 5773–5777. doi: 10.1073/pnas.1404402111
6. Teitelbaum MS (2008) Research funding. Structural disequilibria in biomedical research. Science321(5889):644–645. DOI: 10.1126/science.1160272
7. Mohit Aron: Learning to Invent Knowledge (2017) Rice University, featured Entrepreneur profiles. http://csprofiles.rice.edu/2017/12/12/aron/