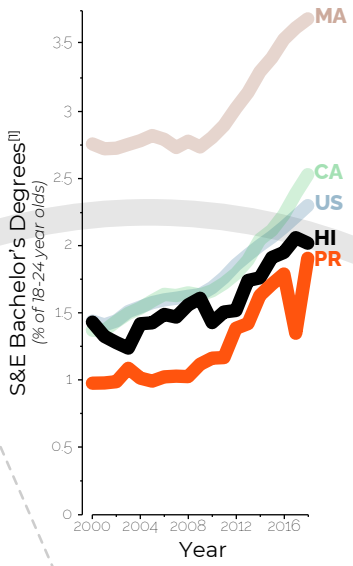
People+Innovation:

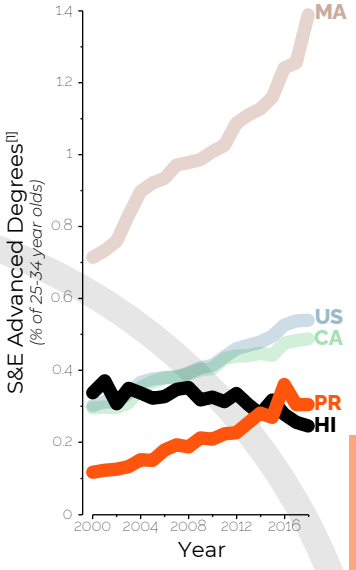
An Inventory of Human Capital in US Islands

Solving new problems requires new solutions. The cycle of innovation, particularly in biotechnology, is driven by a traditional recipe: **1) Advanced Degrees** (Masters, Doctoral) in Science and Engineering (S&E) performing research in academic research institutions. **2) Publication of papers, filing of patents** to share and protect discoveries and inventions. **3) Private venture capital funding** of new businesses to commercialize and scale up technologies, leading to a **4) growth in R&D jobs** for advanced degree holders and attractive opportunities for new generations to continue the innovation cycle. This model has found great success in leading STEM industry states such as Massachusetts and California, **but are our island communities on track to follow this traditional model of innovation, or must we pursue an alternative strategy?**

While the number of S&E bachelor's degrees have grown consistently over the last 10 years, the rate of advanced degrees has not kept pace in Puerto Rico and declined in Hawaii.

With majority of the R&D in academia performed by these advanced degree seekers, it is no surprise that the rate of R&D expenditure and output of papers and patents in PR and HI lag significantly behind the rest of the US.



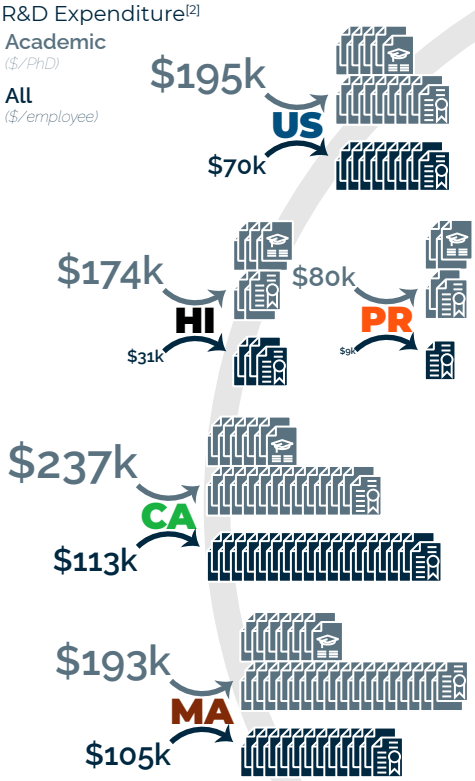


With mixed prospects for opportunities in S&E in PR and HI, the attractiveness of pursuing S&E at an advanced level has diminished, lagging behind CA and MA.

Per Capita R&D Expenditure[2]

Academic
($/PhD)

All
($/employee)



R&D Output[2]

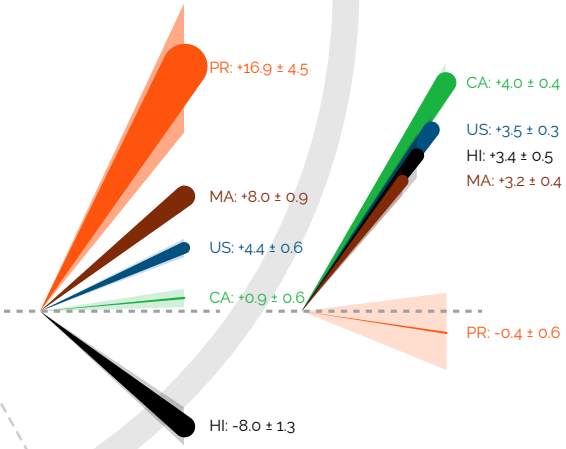
- *1 Journal Article* published per 10 Academic Science & Engineering PhD
- *1 Patent* granted per 1,000 Academic Science & Engineering PhD
- *1 Patent* granted per 1,000 Science & Engineering Employee

Advanced Degree Job Growth[4]

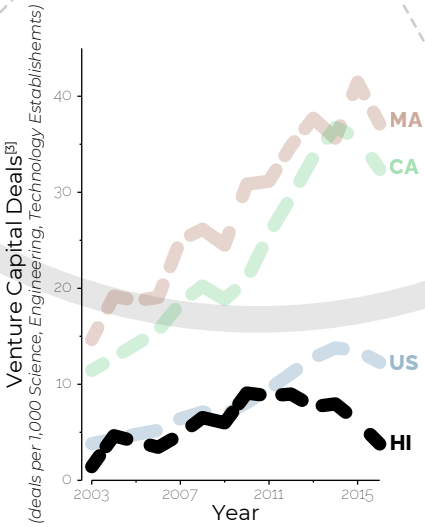
Change in advanced degrees/100 positions in Science & Engineering occupations per year (2005-2018)

Science & Engineering Job Growth[4]

% change in Science & Engineering positions per year compared to 2005 (2005-2018)



With a smaller output of commercializable R&D in the form of patents and papers, venture capital investment in HI has declined in recent years, which stymies the rapid formation of startups translating those discoveries into real world jobs.



Two different responses have developed:

In HI, the new work force of bachelor's level has led to a growth of total S&E jobs, but a significant drop in the proportion of advanced degrees granted in state.

In contrast, PR has dramatically shifted their S&E workforce to higher degree positions at the expense of a stagnation and slight decline in total number of S&E jobs.

Notes and References:
All data was calculated based on the National Science Foundation (NSF) Science and Engineering State Indicator data set (2020): https://ncses.nsf.gov/indicators/states

[1] Bachelor's degrees in S&E were taken from dataset S-19. Advanced degrees in S&E were taken from dataset S-22 normalized by the population of 25-34 year olds from dataset S-21. Values represent 10-year (2010-2019) averages.
[2] R&D expenditures for academic and all sectors were calculated with data taken from S-41, S-46.
R&D outpus were calculated from dataset S-49, S-50, S-51. All values represent 10-year (2010-2019) averages, normalized by the values from [1].VE
[3] VC deals were compiled from dataset S-59
[4] Growth in S&E positions were calculated from a linear regression of dataset S-32. Advanced degrees per position were calculated from a linear regression of [1] and [4].

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