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IUCRC Program Findings from The Center Structure Database

FY2021

Data collected from 70 out of 70 total active centers
Trends from Center Structure Database: FY1980-2021

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*IUCRC Evaluation Project at
VentureWell*

*Based on work by
McGowen, L., Schaible, S.E. & Stoica, A.M.*

*IUCRC Evaluation Project at
North Carolina State University*



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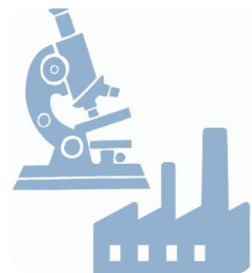
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FY21 Member Fast Facts



1,057 Memberships
164 new and 255 terminated



\$41M Provided by Members
52% of total IUCRC program funding



~15 Memberships per Center

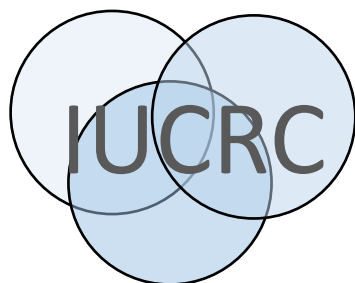


Median Membership fee
leveraging ratio 1:29



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FY21 IUCRC Center Structural Fast Facts



70 active Centers at 205 University sites



1,057 Memberships



1,320 Researchers + 1,807 students



\$74.5M in Total Program Funding; \$1.1M per center



NSF invests \$17.6M; \$251K per Center

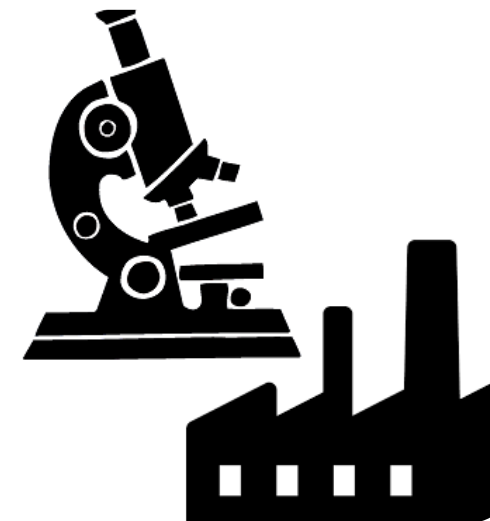
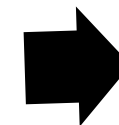
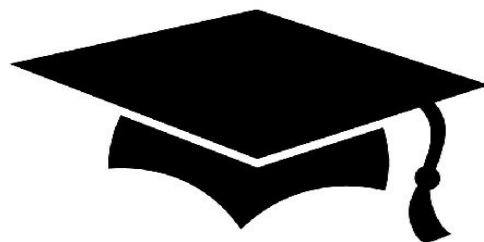


NSF Leveraging ratio 1:2.3



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IUCRC Student Fast Facts: FY2021



1,807 Students Trained
~26 students per center

623 Students Graduated

- ~9 graduates per center
- 34% of trainees annually

383 Alumni Hired by Industry

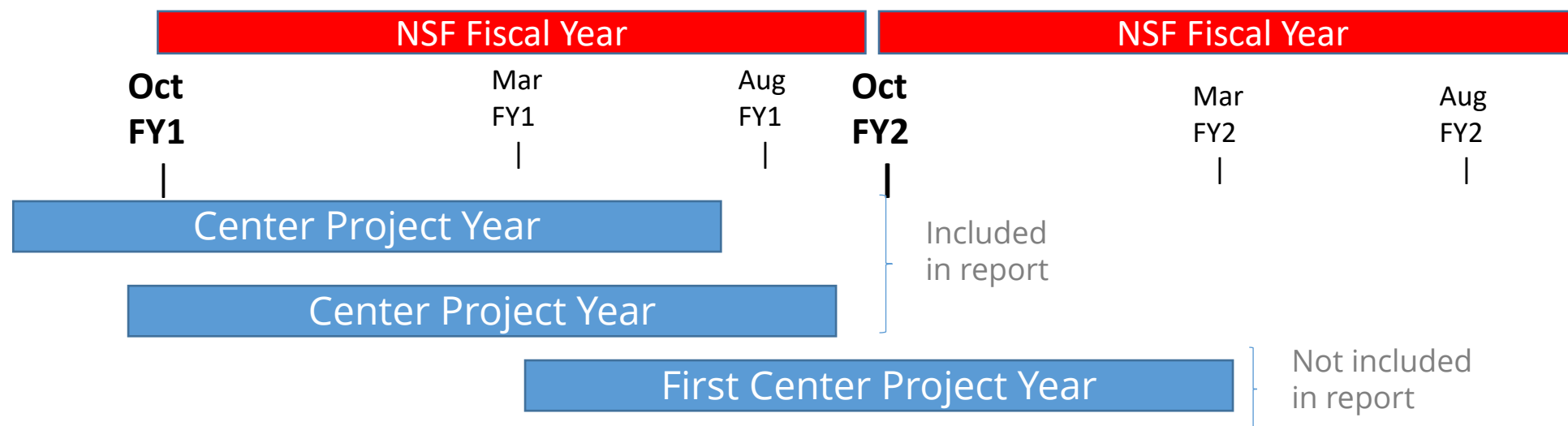
- 65% of graduates
- 22% by industry members



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NSF and Center Budgeting Life Cycle

- Structural report includes activities for most recently completed award year
- Excludes centers with less 1 complete year in operation





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Methodology

- Collection of FY2020-21 structural data from centers and sites completed in March 2022.
 - Centers were asked to report on their award year ending during FY2021 (10/1/20 - 9/30/21)
 - Data request synced with award end date and NSF annual reporting timeline for each center
 - Includes centers on No Cost Extension (NCE)
- Data on number of funded centers collected from NSF (through 2021)
- Reporting issues
 - Need to develop decision rule for reporting time frame when a center gets a new award that changes their reporting time frame
 - Sometimes change in award dates can cause overlap or gaps between fiscal years

Understanding Center Counts Through FY2021



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FY 2021

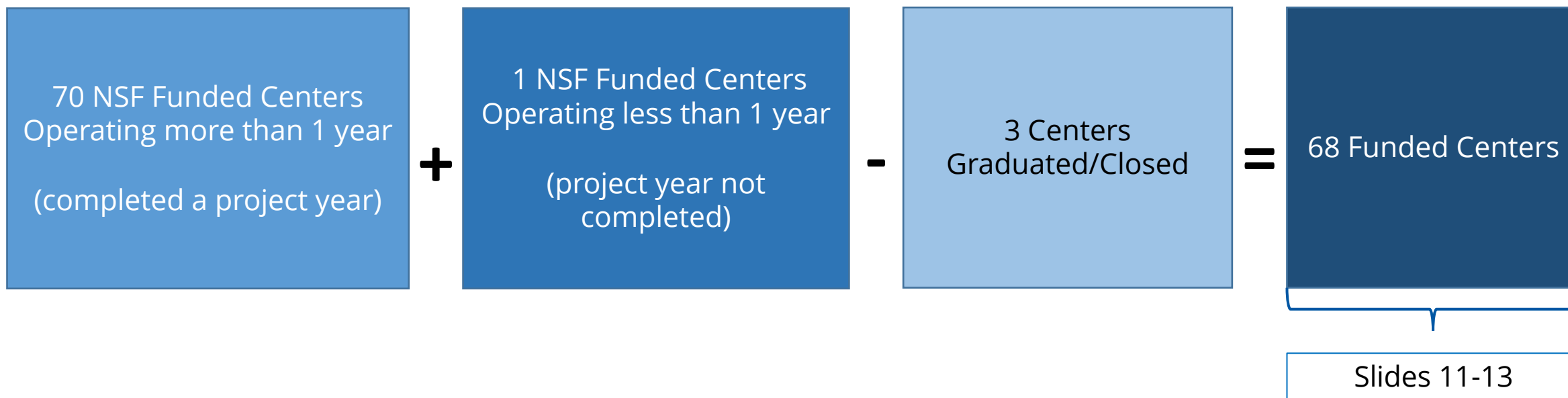


Understanding Center Counts Through FY2021



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FY 2021





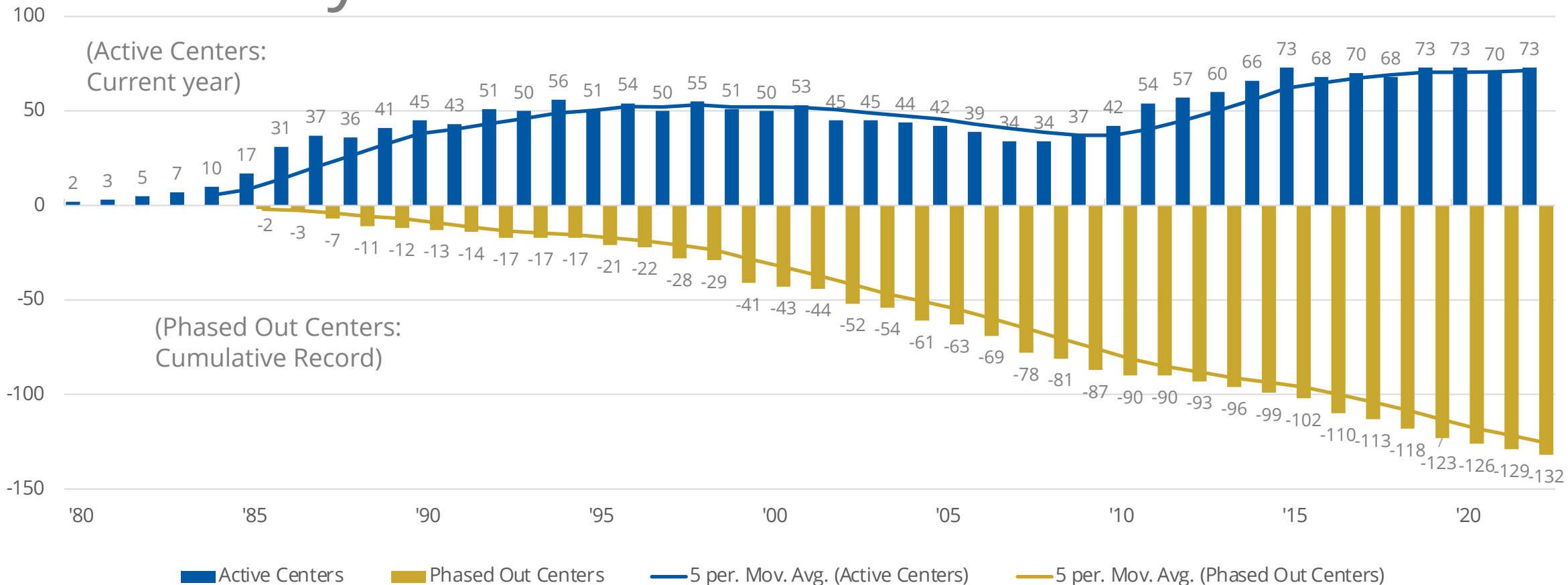
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Centers & Sites



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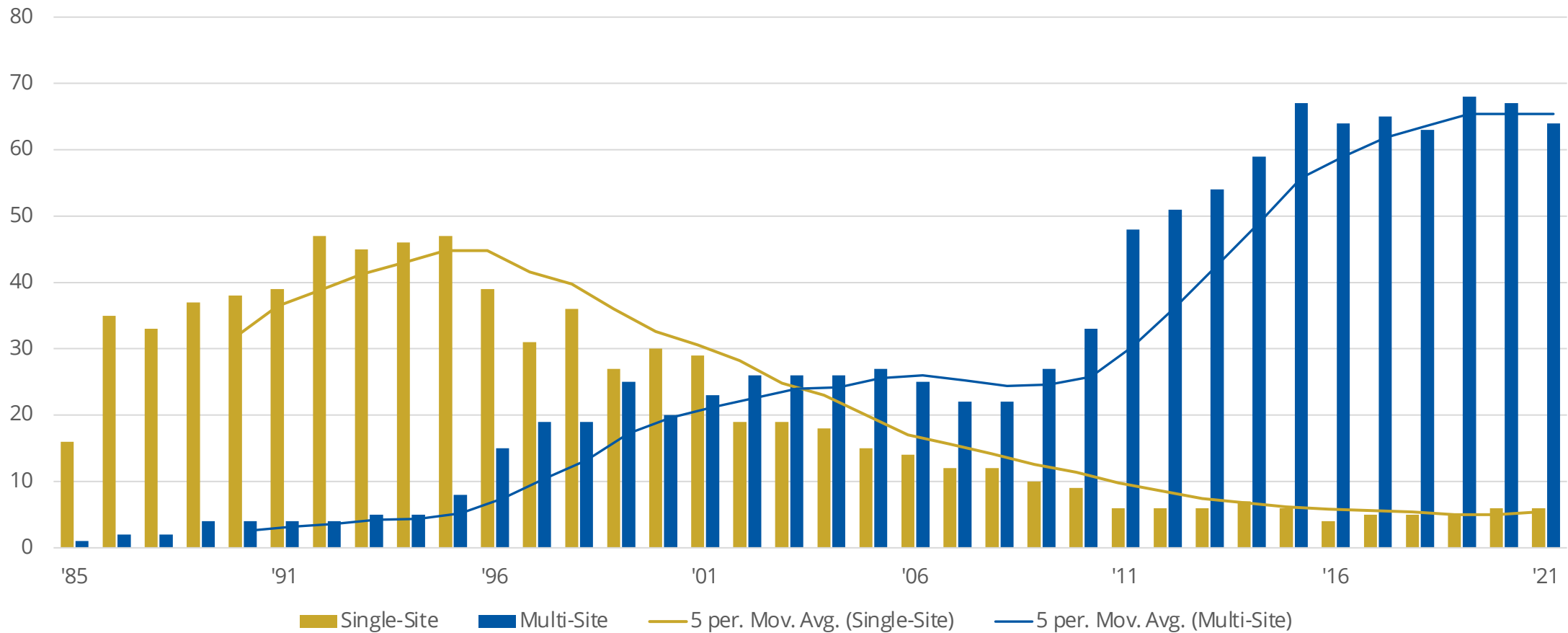
Number of Active and Phased-Out Centers by Year



Number of Single & Multi-Site Centers by Year



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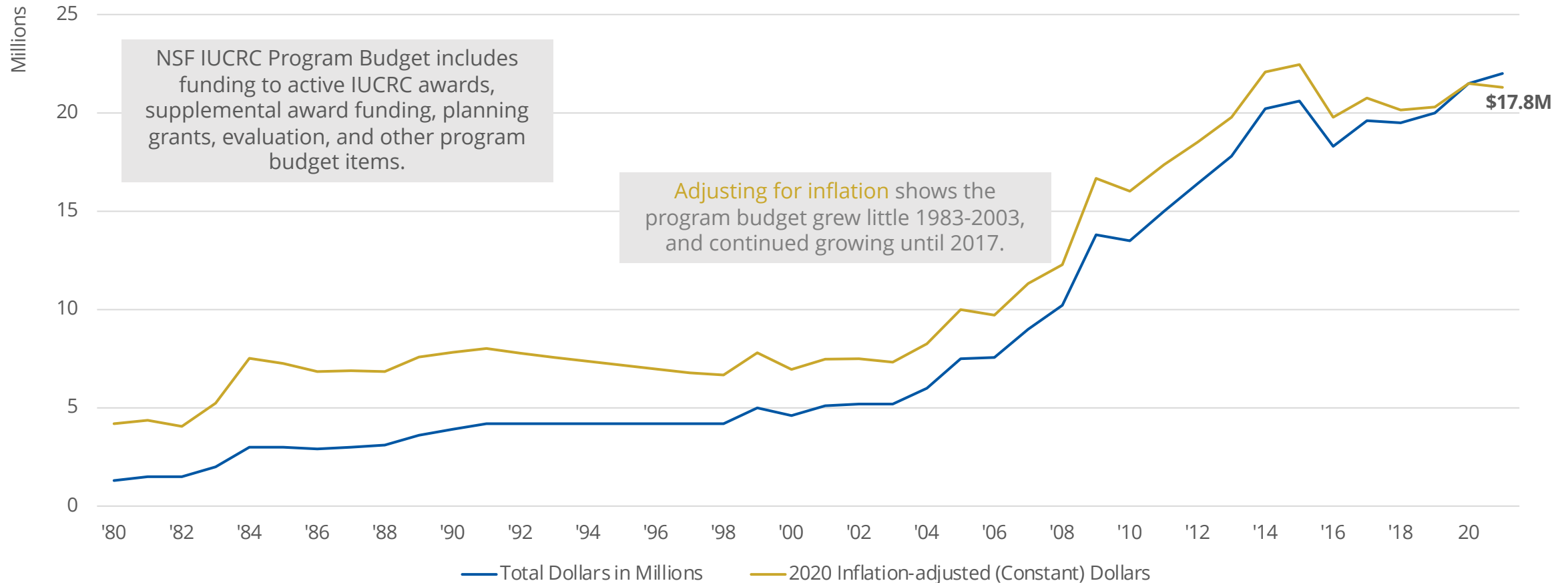
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Program & Center Funding

NSF IUCRC Program Budget by Year: Total Dollars



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IUCRC Center Funding Sources

Income Sources

NSF IUCRC Investment

IUCRC Award & Supplements: Annual base IUCRC award and grant supplements

Program Income

Member Fees: Fees paid by member organizations (large and small industry, federal, state, and local govt, and non-profits), including fed membership fees paid via IAA/MIPR, for IAB voted funding pool

Additional Member Support: Add'l funding from member organizations, not voted, but results shared with the IAB, including (but not limited to) additional fed funds transferred via IAA/MIPR by member agencies

Additional Center-Catalyzed Funding Support

Other NSF: Any other grant funding from NSF for research that is shared with the IAB, not included in the IUCRC award & supplements

Other Federal: Other grant funding from federal agencies for research that is shared with the IAB

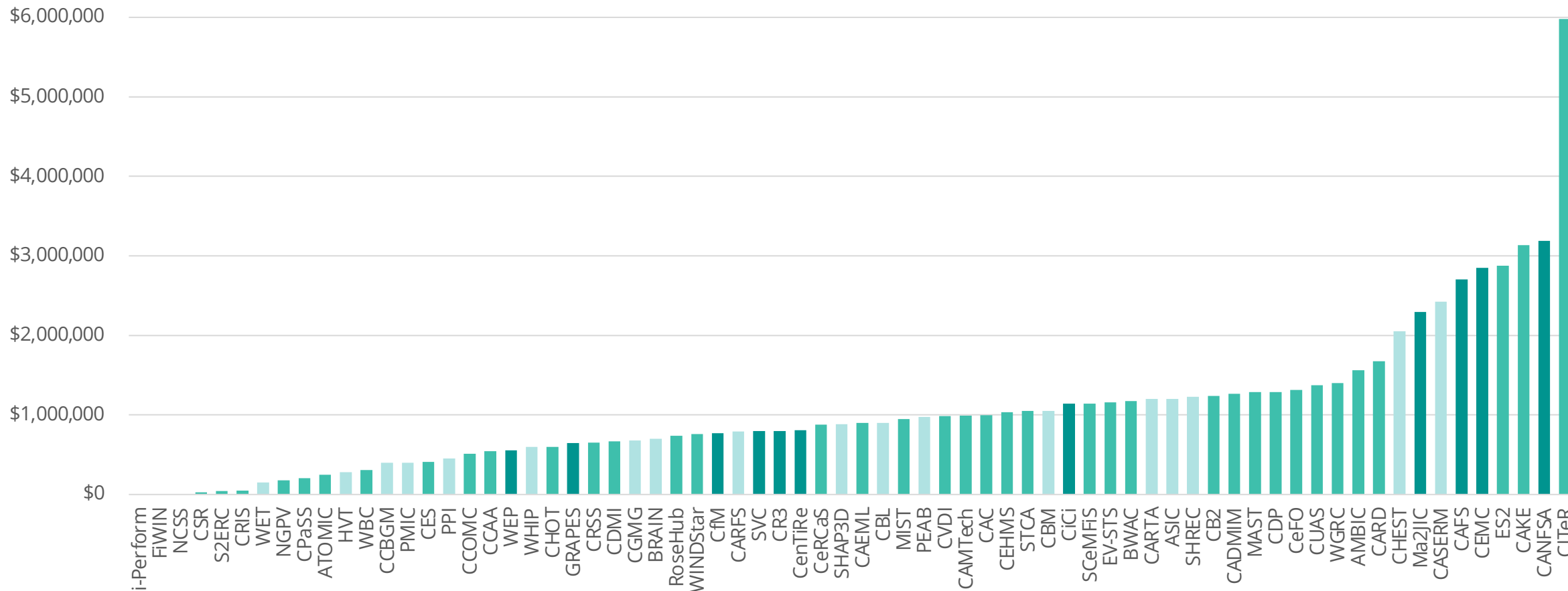
Other Non-federal: Funding from non-federal sources (e.g. foundations) for research that is shared with the IAB

Other State/local: Funding from state or local government agencies for research that is shared with the IAB



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FY2021 Total Center Funding by Center*



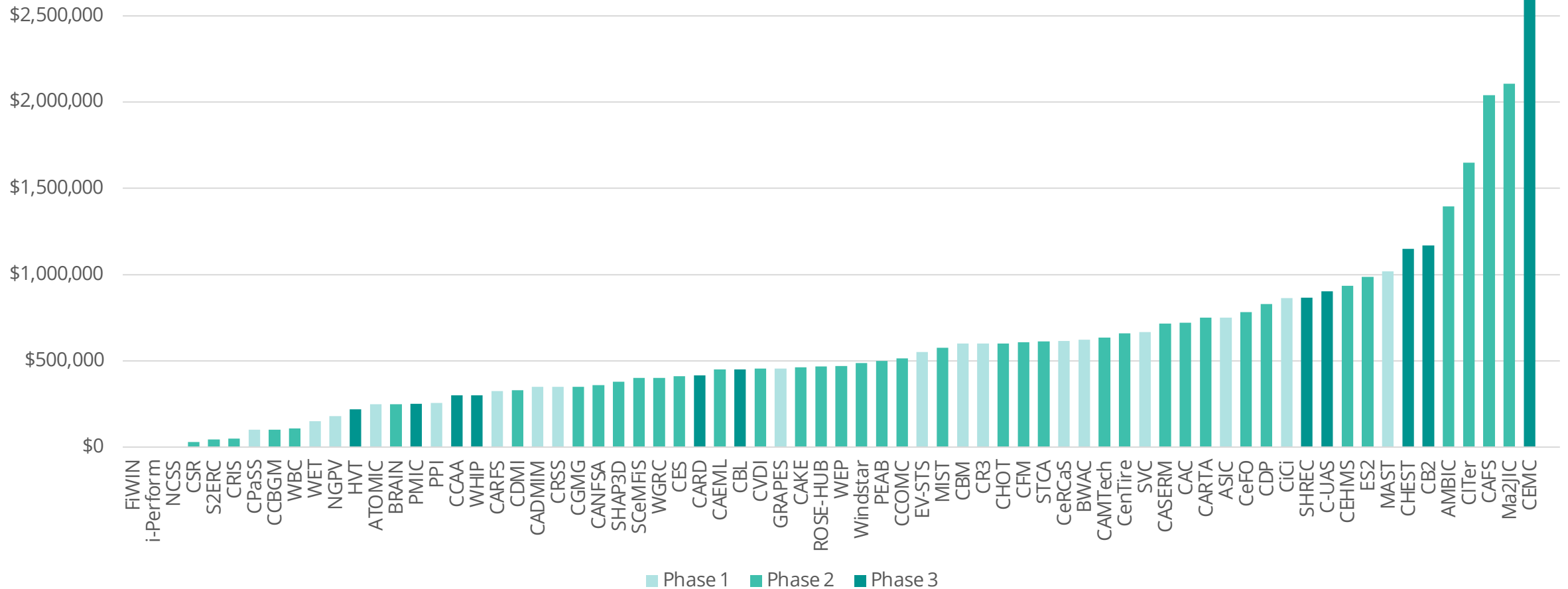
*Includes Center-Catalyzed Funding

Phase 1 Phase 2 Phase 3

FY2021 Total Center Program Income by Center



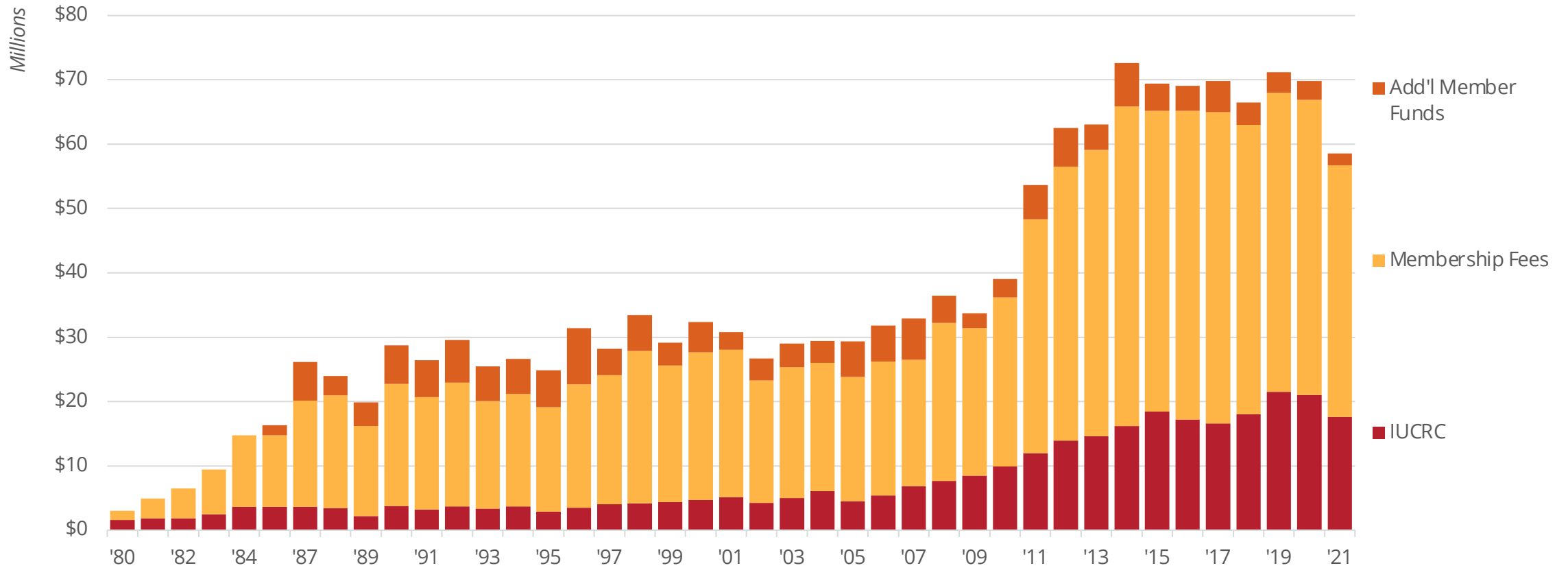
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NSF IUCRC Funding + Program Income by Year in Dollars



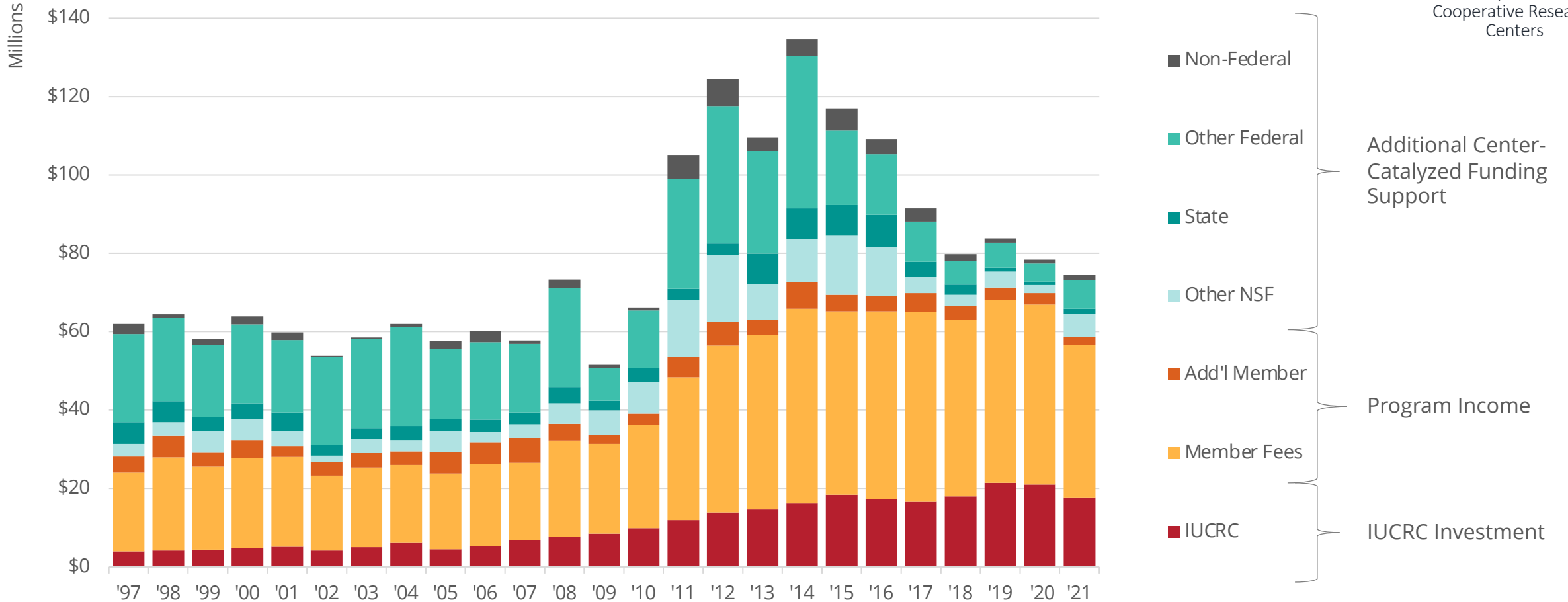
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Total Funding by Source by Year in Dollars¹



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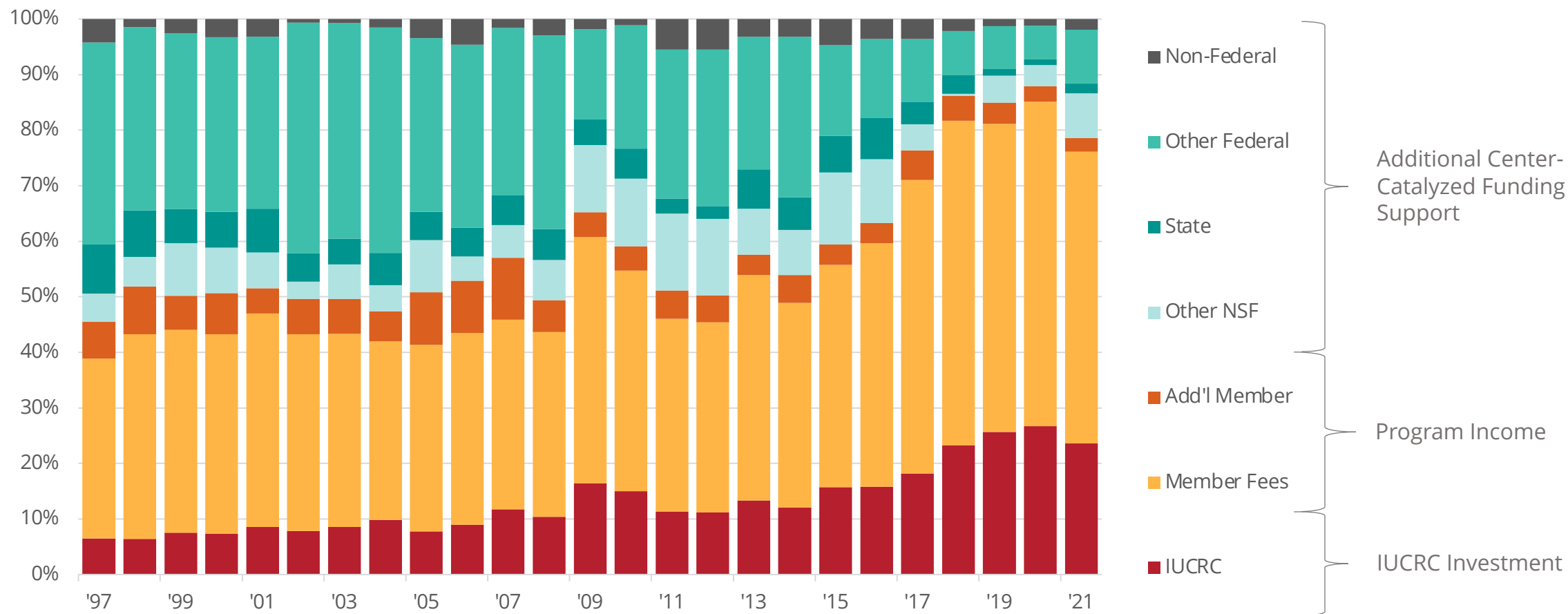


¹Univ. & Other Cash data collected prior to FY2016 is excluded



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Total Funding by Source by Year in Percentages¹

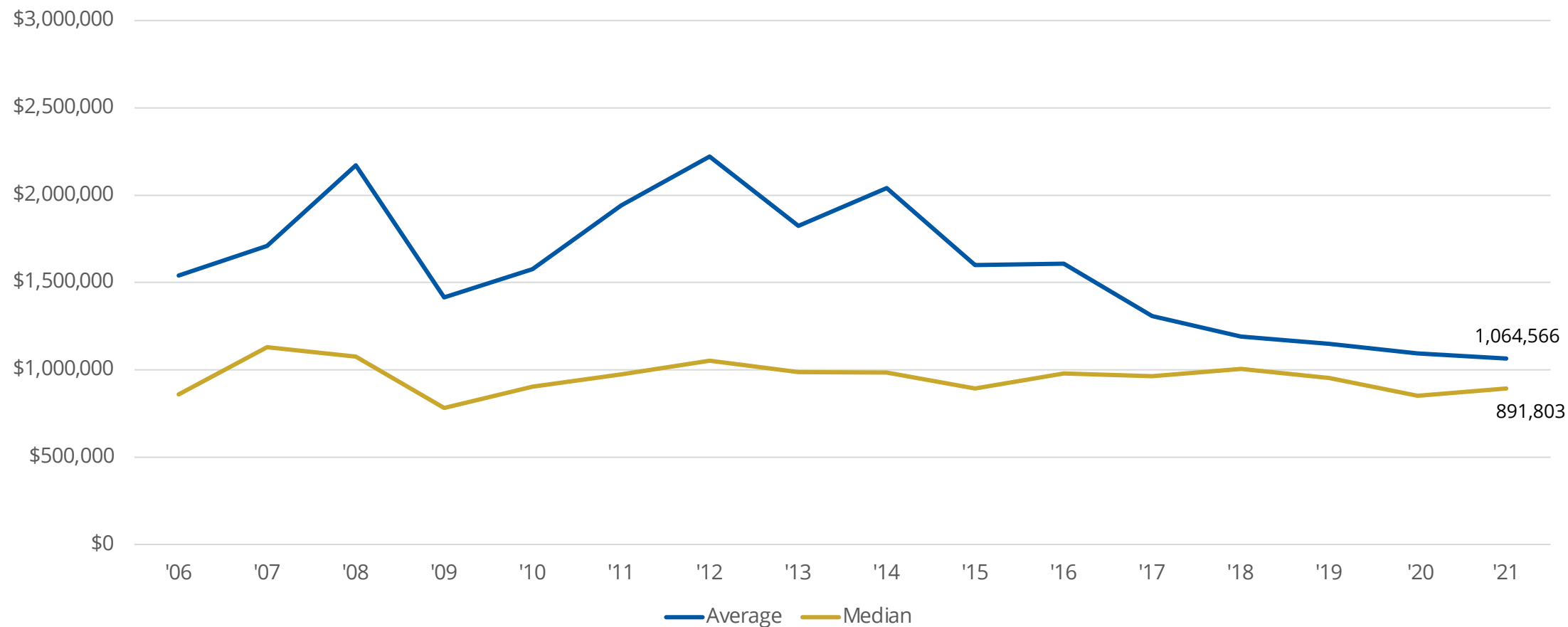


¹Univ. & Other Cash data collected prior to FY2016 is excluded



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Average & Median Total Center Funding by Year¹

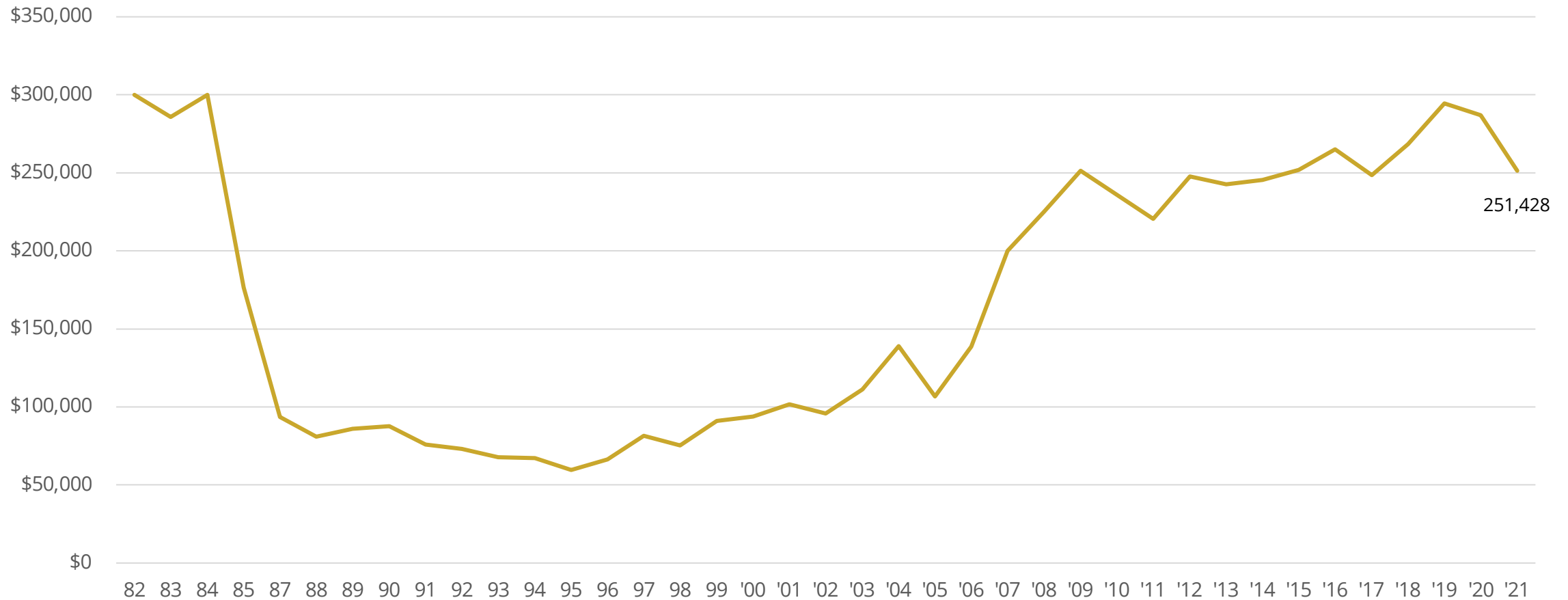


¹Univ. & Other Cash data collected prior to FY2016 is excluded

Average NSF IUCRC Awards & Supplements per Center by Year



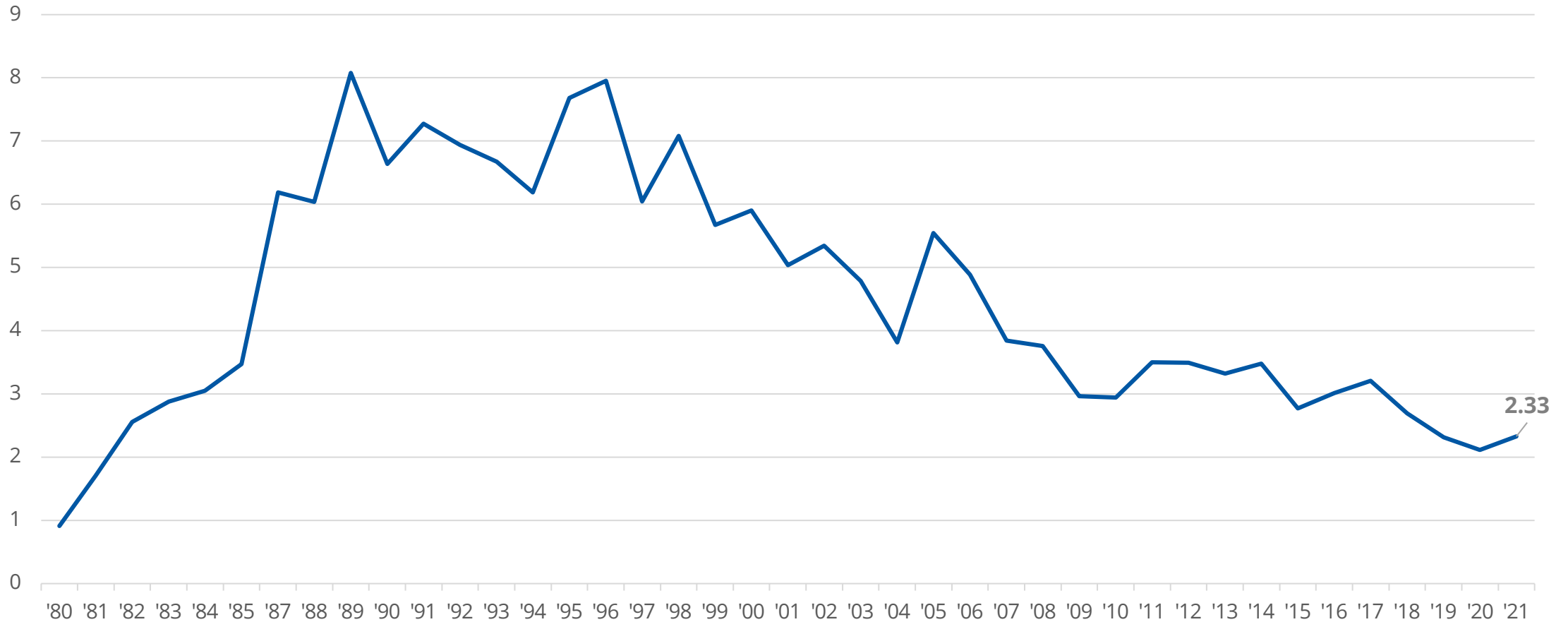
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NSF IUCRC Investment to Program Income Leveraging Ratio by Year



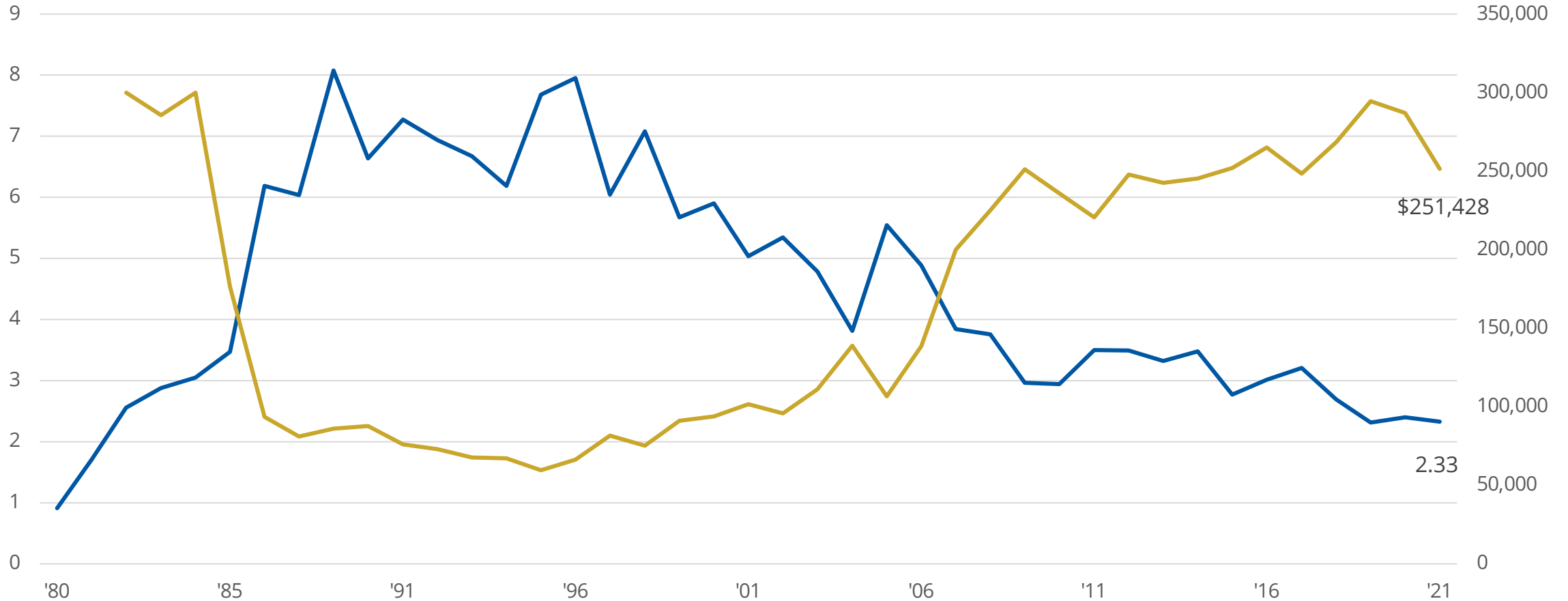
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NSF IUCRC Investment to Program Income Leveraging Ratio is heavily influenced by NSF Award levels



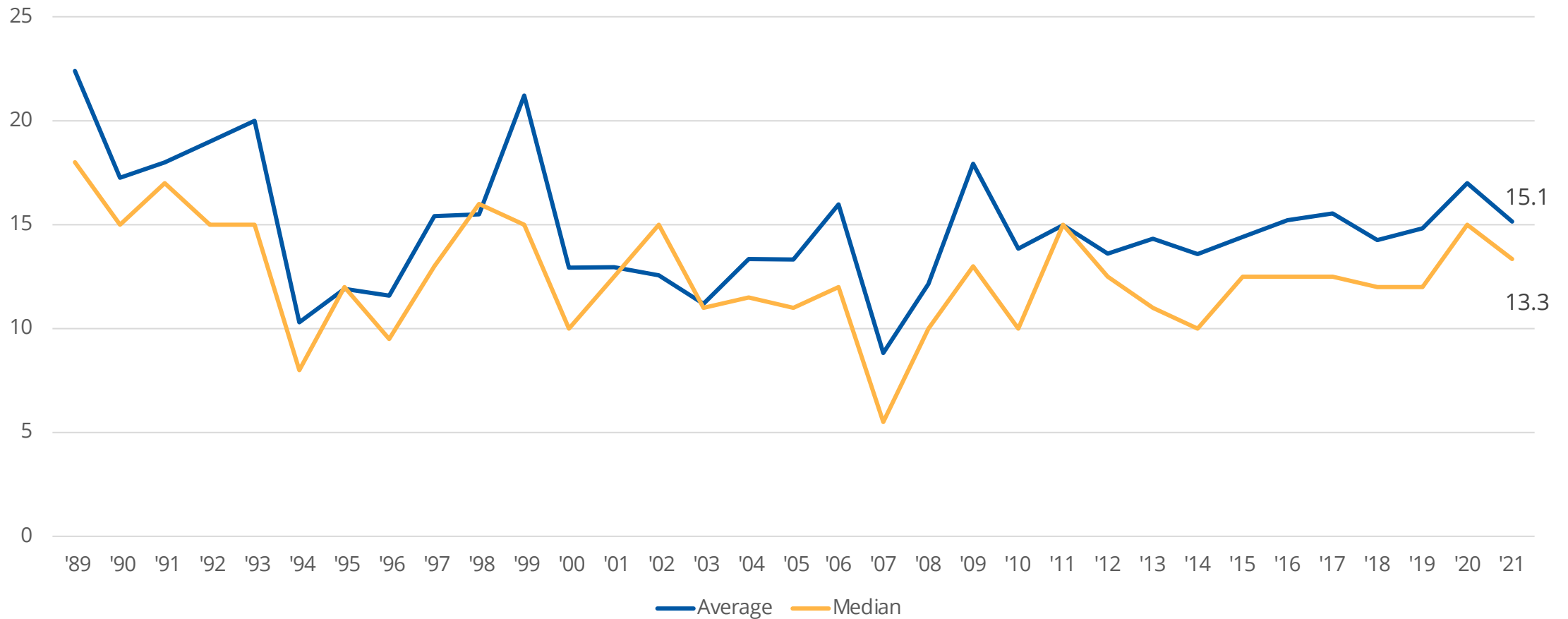
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Percentage of Center Budget allocated to Center Administration by Year



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Membership



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Membership Summary

	Count	Percent
Total memberships	1,057	100%
Industry: large firms (500 + employees)	512	49%
Industry: small firms (< 500 employees)	312	30%
US Government: Federal	151	14%
US Government: State or local	34	3%
Non-profit	29	3%
Other	10	1%
# of organizations with memberships¹	727	--

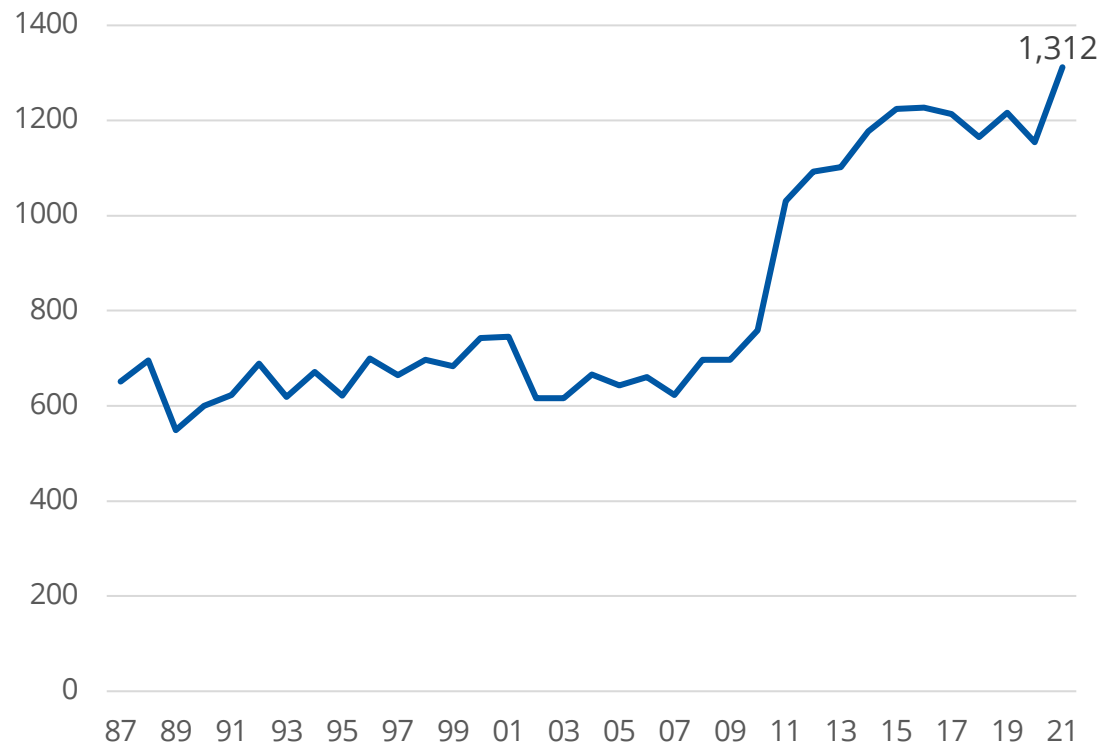
1. Many firms and agencies maintain more than 1 membership in the I/UCRC program. This count considers a firm or agency with multiple memberships as a single member. For example, the Army holds 28 memberships but is considered a single organization in this count.

Total Members and Average Memberships per Center by Year

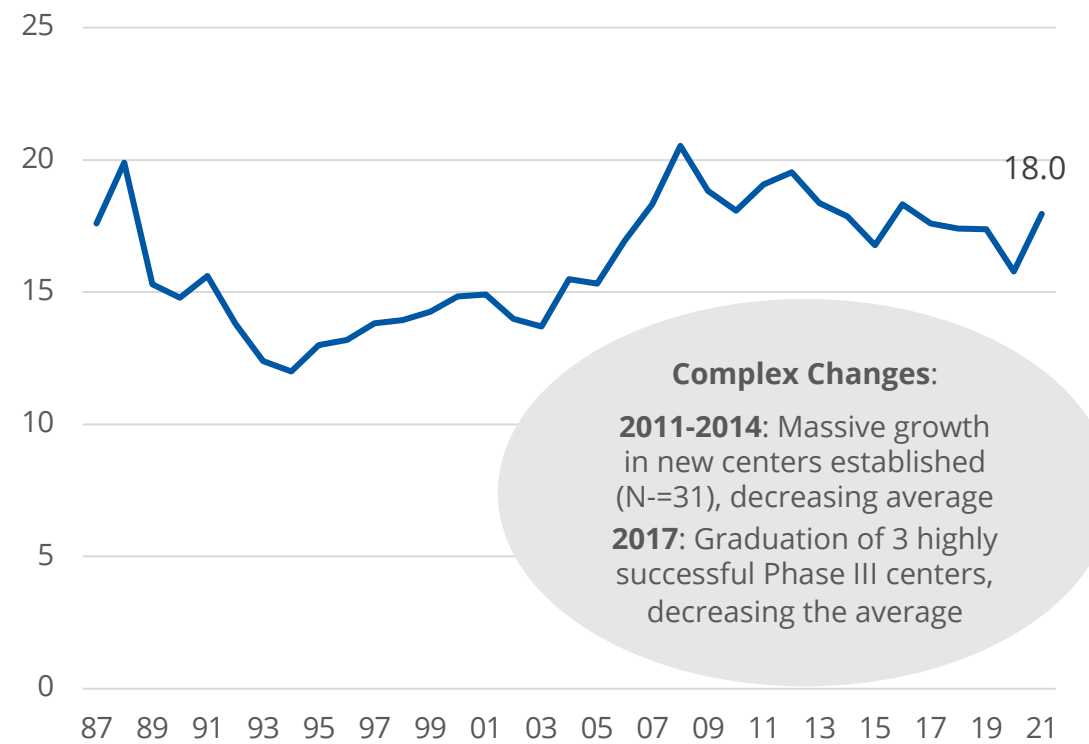


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Total Number of Memberships



Avg. Number of Memberships per Center

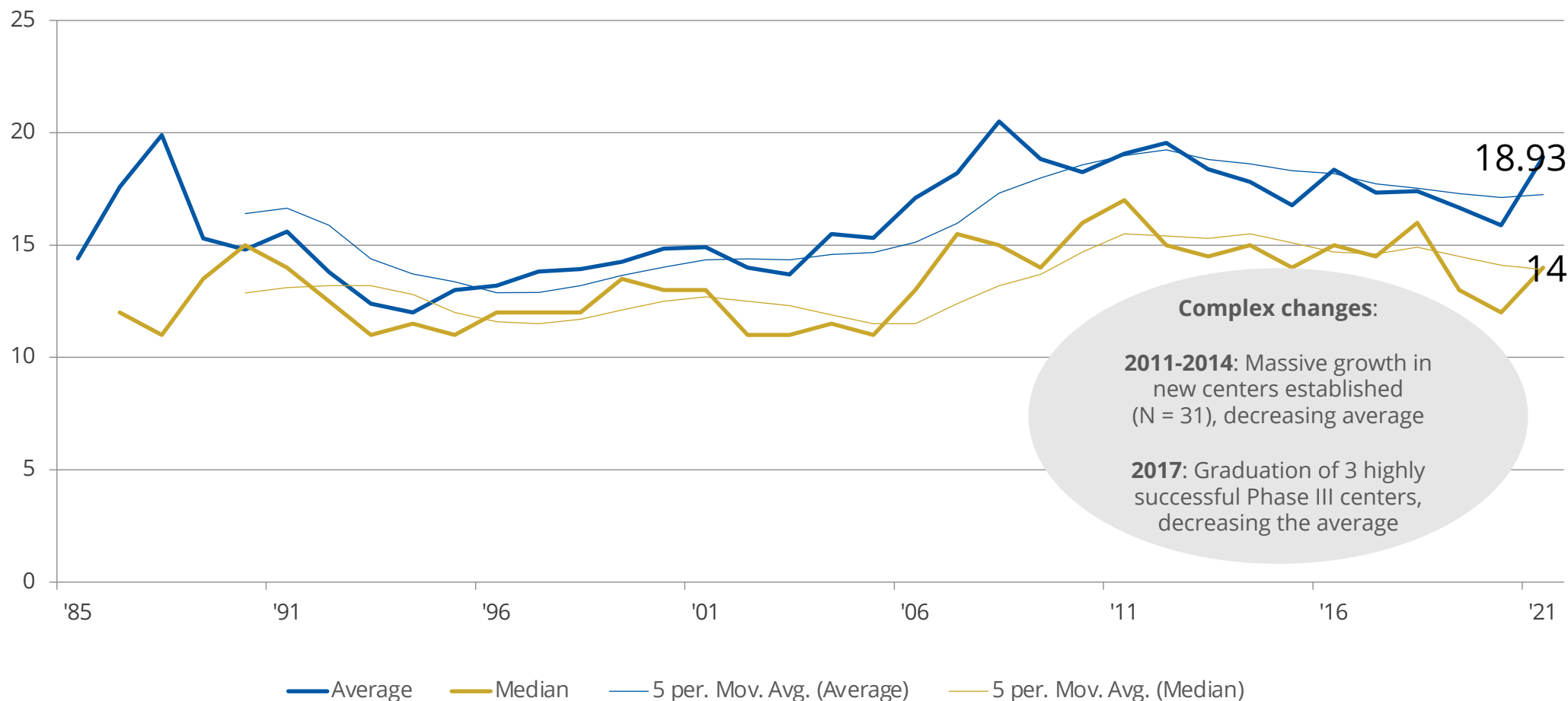


Complex Changes:
2011-2014: Massive growth in new centers established (N=31), decreasing average
2017: Graduation of 3 highly successful Phase III centers, decreasing the average



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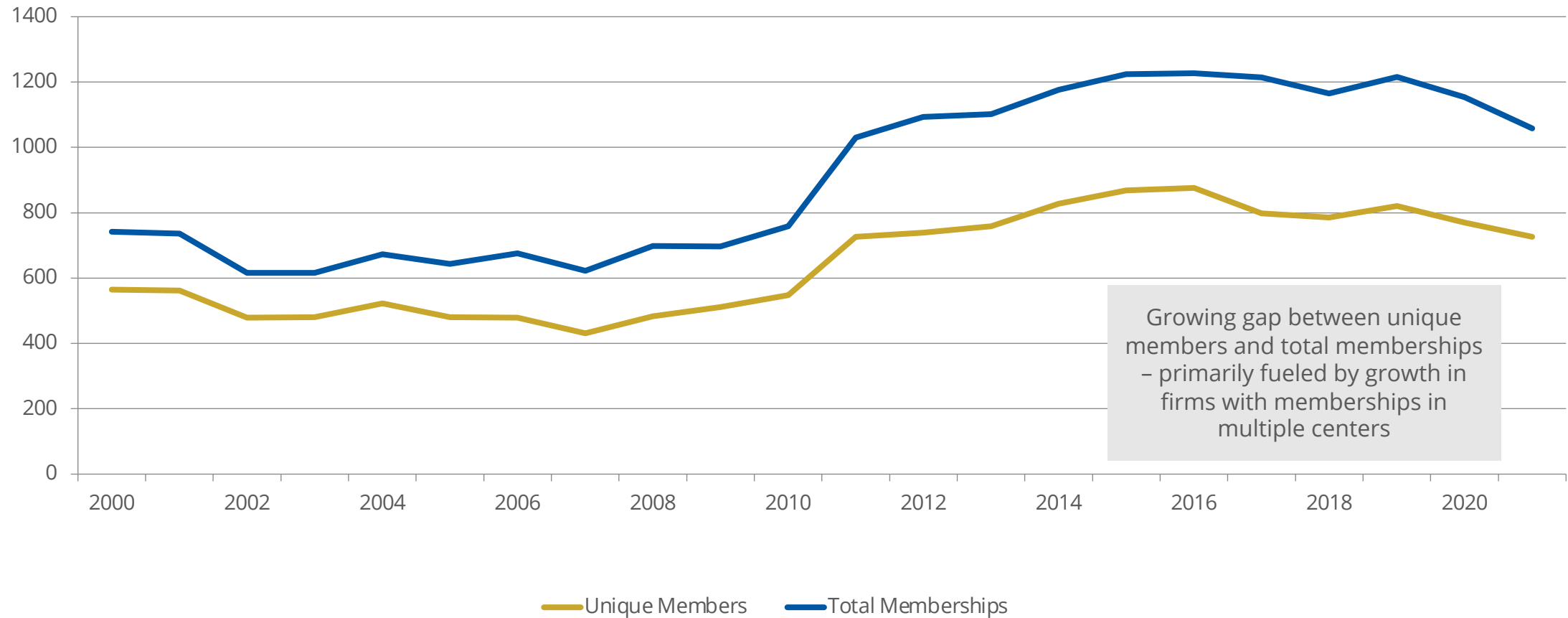
Number of Memberships per Center by Year



Unique Members and Total Memberships Over Time



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Membership: Organizations with the Most Memberships



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N Memberships	Organizations
28	Army
23	Air Force
18	NASA
10	Honda
8	Intel, Navy, Raytheon
7	NSA, DHS, Toyota, Sandia National Lab, Electric Power Research Institute
6	Lockheed Martin, Hancock Forest Management, Cisco Systems,
5	Shell, Samsung, BASF, Weyerhaeuser, Microsoft, Los Alamos National Lab, L3

21% of all memberships
from these organizations

Organizations with the Most Memberships Over Time



1995		2000		2005		2010		2015		2020	
N	Name	N	Name	N	Name	N	Name	N	Name	N	Name
10	Dow Chem.	10	Motorola	17	DoE	26	Army	25	Army	26	Army
9	DuPont	9	Army	13	Army	18	DoE	20	Air Force, DoE	25	Air Force
8	3M, Motorola, Ford	8	Lucent Tech., DoE	10	Boeing	15	Lockheed Martin	15	NASA	21	DoE
7	GM	7	Boeing, IBM, Honeywell	8	Intel, Air Force	13	Boeing, NASA	14	DoD	18	NASA
6	Amoco, Boeing , Texas Inst.	6	Daimler Chrysler	7	Raytheon, HRL, DoD	11	Air Force	12	Lockheed Martin, Raytheon	12	Raytheon
		5	Ford	6	Honeywell, Navy	10	GM, IBM	11	Intel	10	Honda
				5	Dow Chem., Siemens	7	Intel, Raytheon	10	Honda	9	NSA
						5	DoD, Navy	9	Navy	8	DoD Lockheed Martin
											Alphacore Inc., BASF, Boeing, Cisco Systems, Inc., Corning Inc, Corteva Agriscience, DHS, ERPI, Ford Motor Company, Honeywell, IBM, Intel Corporation, Merck, NIST, Samsung, Shell, Toyota, Weyerhaeuser Hancock Timber Resource Group, Navy+
Dropped		<i>Dow Chem., DuPont, 3M, GM, Amoco, Texas Inst., EPA, Navy</i>		<i>Motorola, LucentTech., IBM, Daimler Chrysler, Ford</i>		<i>HRL, Honeywell, Dow Chem., Siemens</i>		<i>Hancock Forest Management, Merck, QualComm, Bayer, Campbell Global, Dell, DuPont, Rayonier, Toyota</i>		<i>Northrop Grumman, L3 Communications, Hewlett-Packard, Huawei</i>	
New		<i>Lucent Tech., IBM, Honeywell, Daimler Chrysler, DoD</i>		<i>Intel, Air Force, Raytheon, HRL Labs, Dow Chem., Siemens, Navy</i>		<i>Lockheed Martin, NASA, GM, IBM</i>		<i>Alphacore Inc.</i>		<i>BASF, Corteva Agriscience, Merck, NIST, Shell, Toyota, Hancock Timber Resource Group,</i>	

Increased Defense / Defense Contractors

Overall Increase in Firms with Multiple Memberships

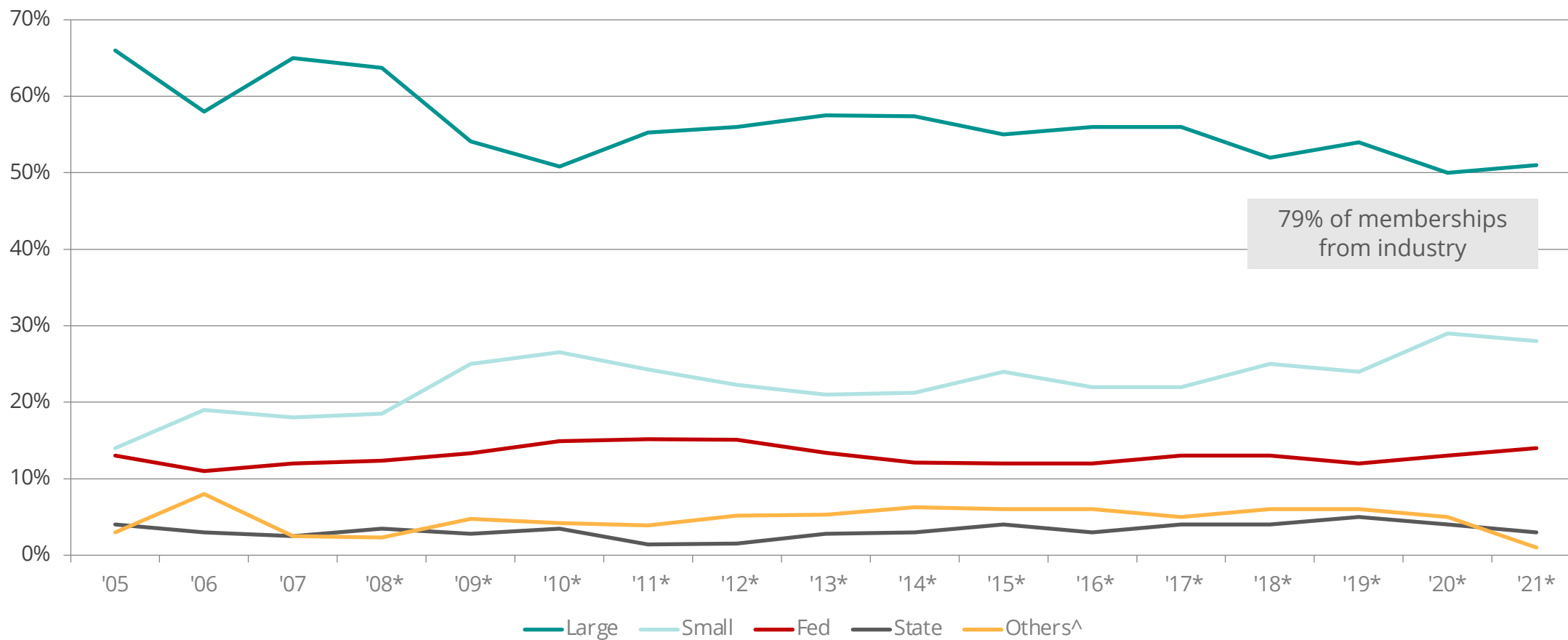
Alphacore Inc., **Boeing**, Corning, Cisco, **DHS**, EPRI, Ford, Hewlett-Packard, Honeywell, Huawei, IBM, **NSA**, L3 Communications, **Northrop Grumman**, Samsung, Weyerhaeuser

5-8
5-6



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Membership Composition by Year*



79% of memberships from industry

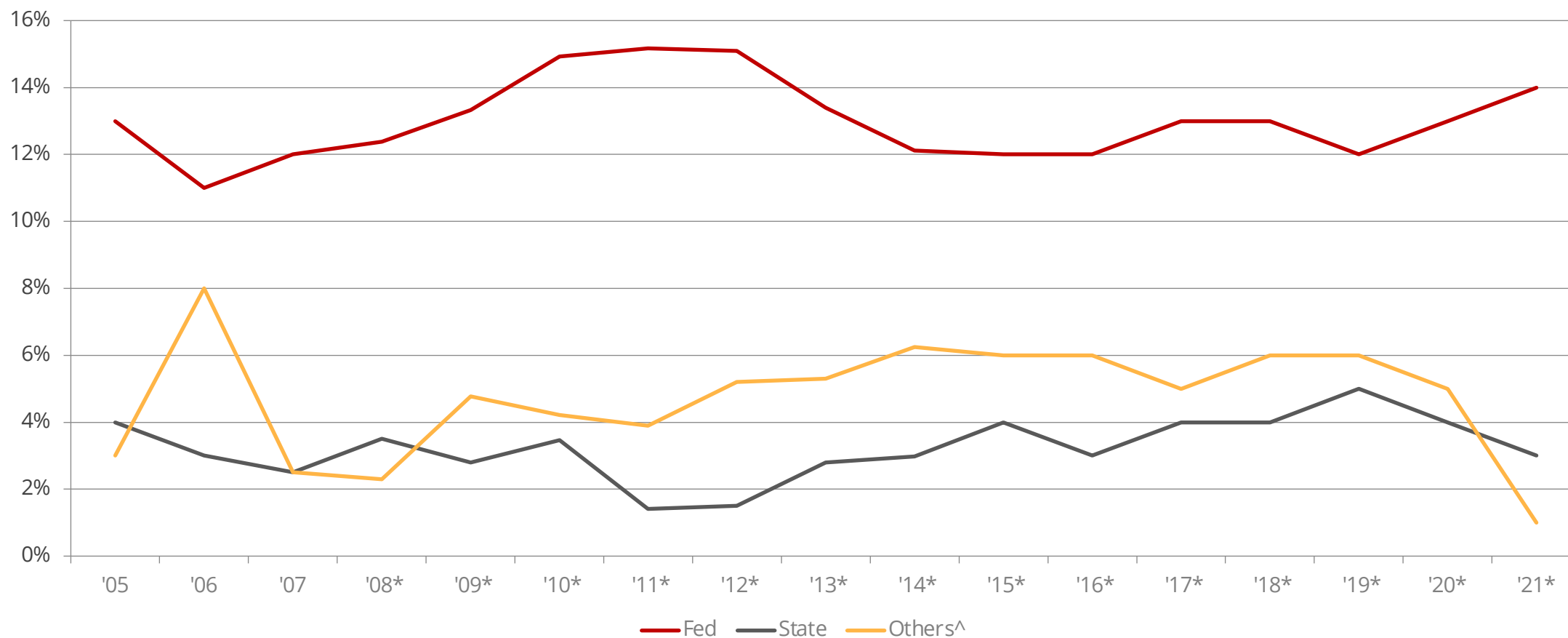
*Advanced Forestry excluded as an outlier: 2008-21.

^ Categories comprising Others include: non-profit, non-US gov't, and other org.



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Membership Composition by Year*

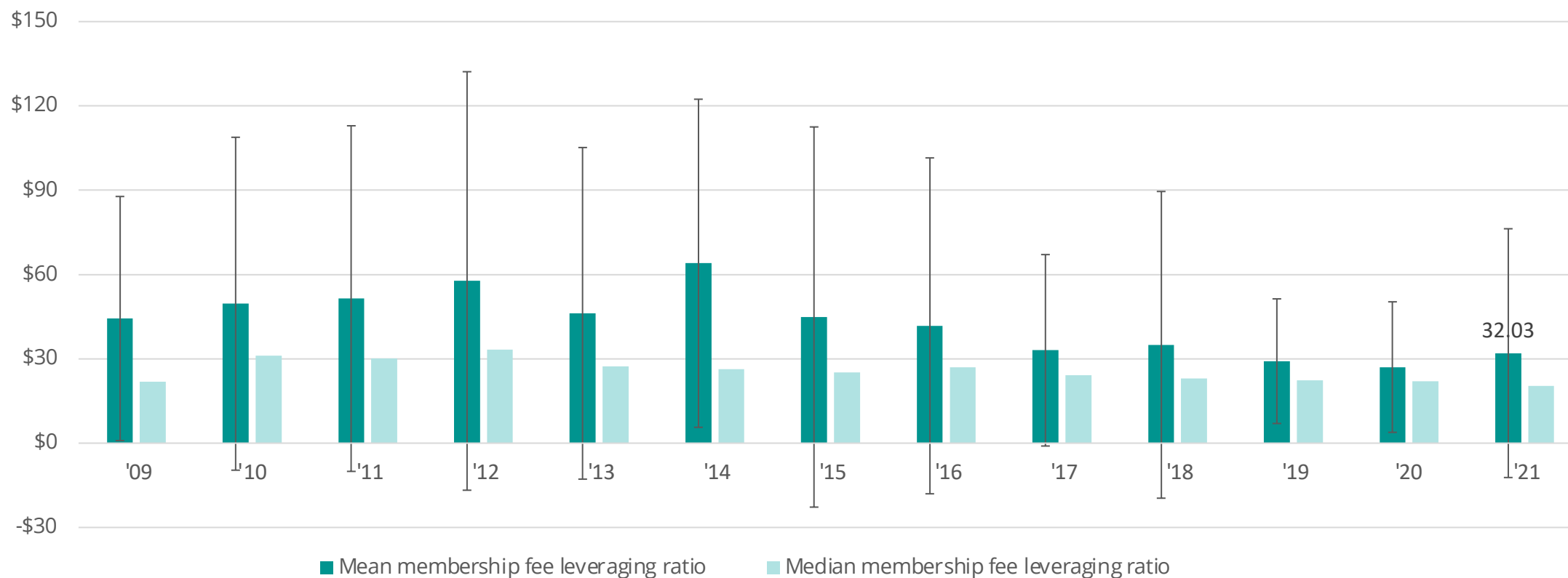


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Average Membership Leveraged Dollars per Center by Year

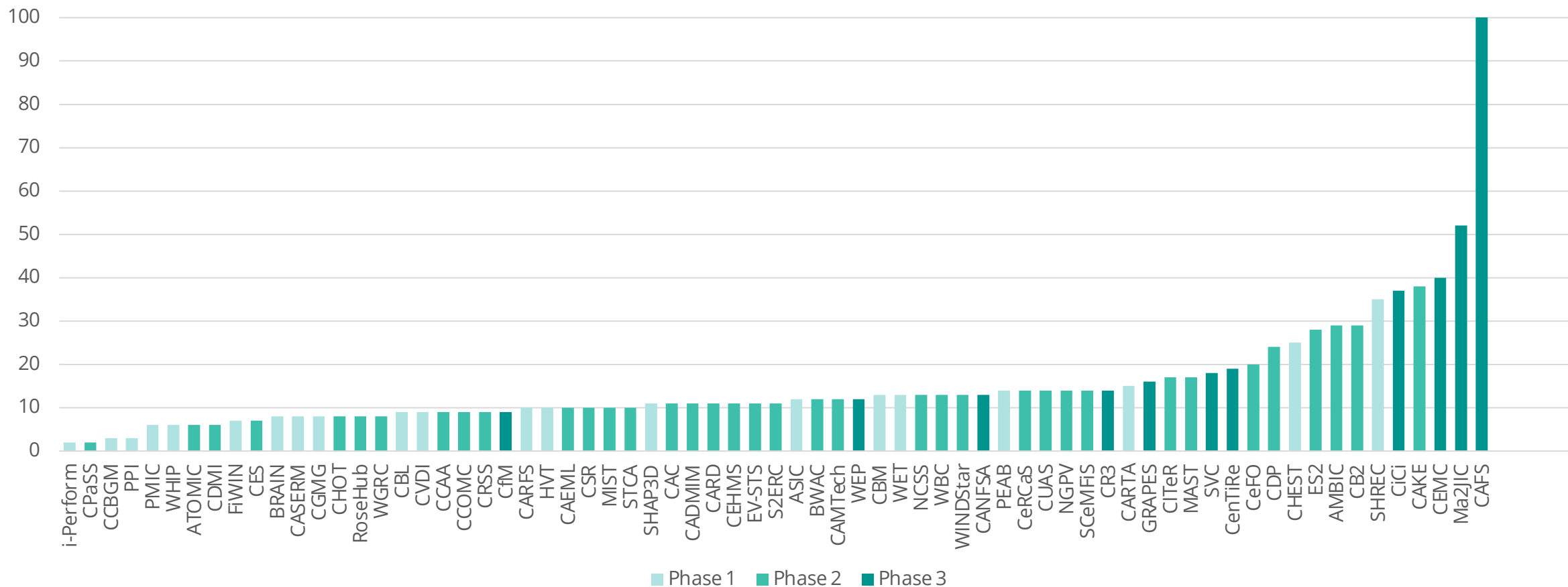


- Membership fee leveraging refers to the amount of center funding leveraged by each dollar of membership fees.
- In FY2020, for every dollar a member invested in the center, they leveraged \$29 in center research funding.
- Membership fee leveraging = (total center budget / (total membership fees/number of memberships))-1



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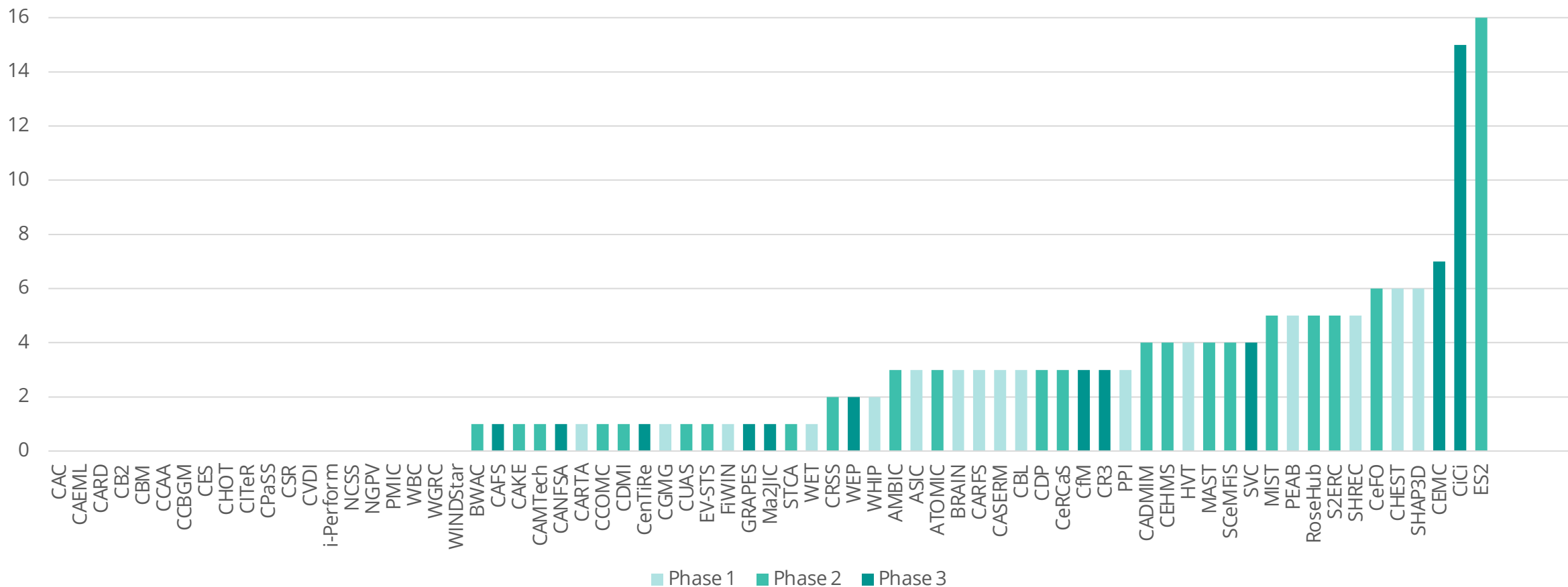
FY2021 Total Center Memberships





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FY2021 New Center Memberships





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Interpreting Membership Changes Over Time



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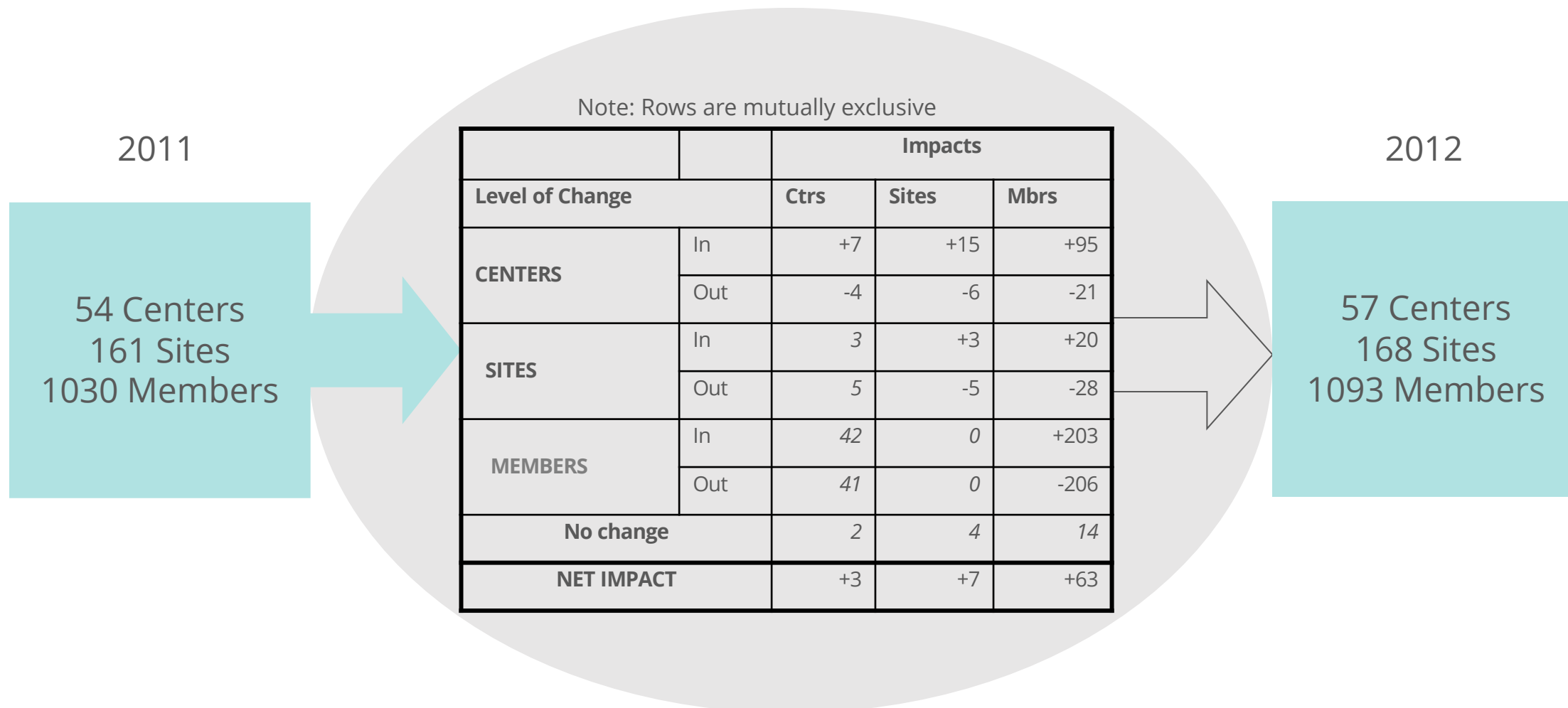
Interpreting Membership Changes Over Time

- Changes in Membership numbers over time are influenced by changes at different levels:
 - Members: Individual members will leave a center and new members will be added
 - Centers: Mature centers will graduate (and their members will be dropped) and new centers will be created (and their members added)
 - Sites: New sites (and their members) are added to existing centers
 - Changes in the national and international economy, public health, and other factors can also have an impact
- Changes in program totals and averages per center can be due to any combination of these factors



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Example: 2012 IUCRC System Changes



Membership Turnover Variables and Indicators



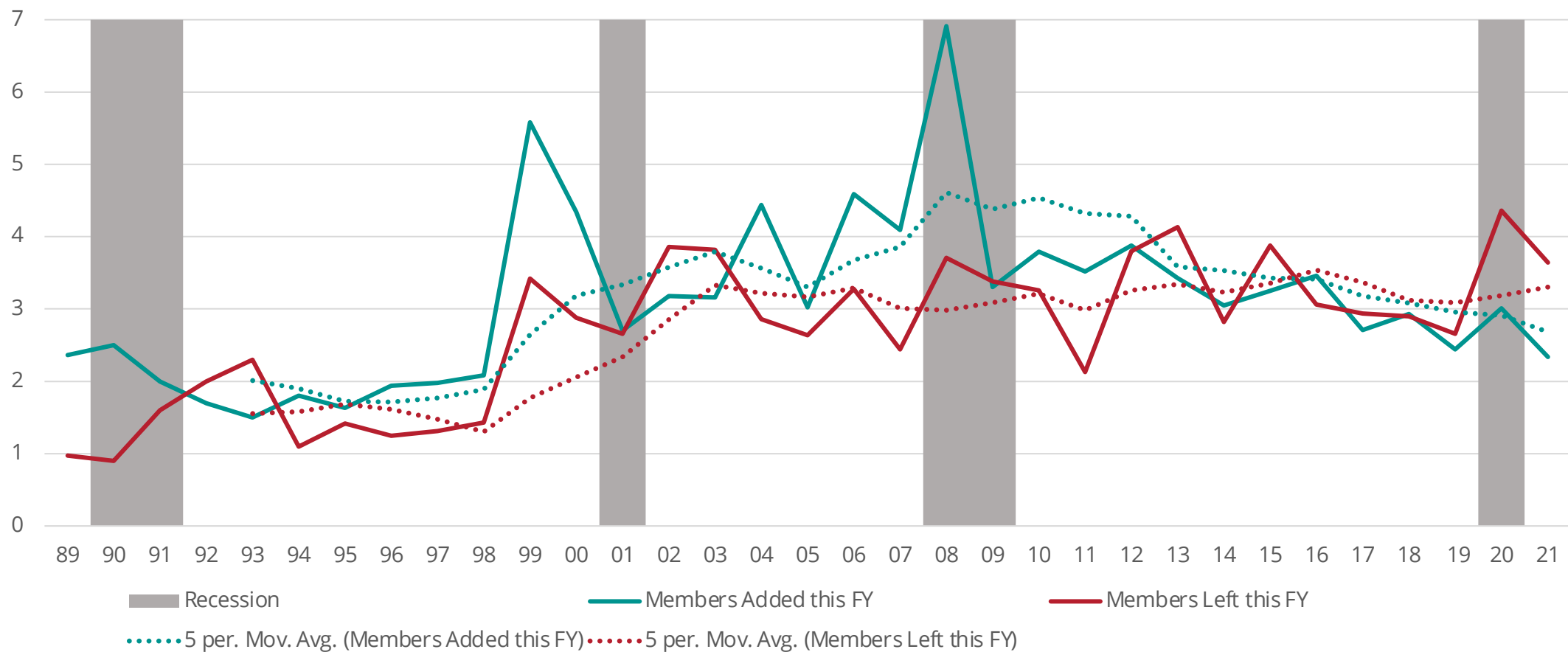
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- **Members added:** number of members center reports adding during past year (may include new individual members or members from added site)
 - Does not include addition of new centers
- **Members left:** number of members a center reports leaving the center during past year (would only include site-level loss if site left center)
- **Member Net Gain/Loss:** the relative gain or loss of members (members added – members left) centers experience during each calendar year
- **Member Turnover:** percentage of a center's members from year x that leave the center the following year ($\text{year } x + 1$)
- **Aside:** Other membership indicators NC State has looked at:
 - Dwell time, turnover by center fidelity to IUCRC model, membership for single vs. multi-site centers, private vs public sector membership, fortune ranking of members, defense membership, phase based growth and retention, firms with multiple memberships, Chinese firm membership



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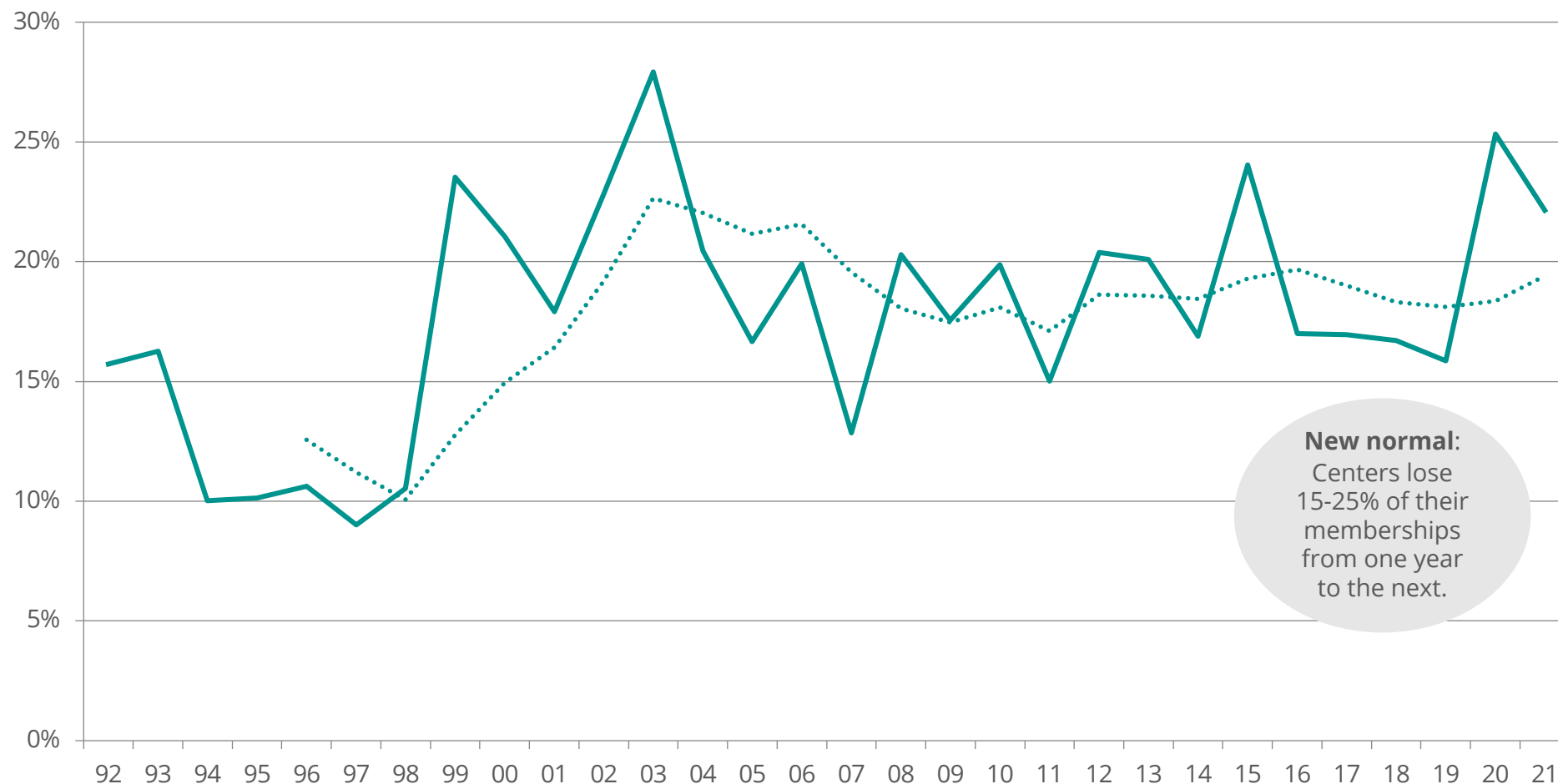
Average Membership Gain/Loss





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Membership Turnover Rate



Turnover % = Members terminated in year X+1 / Total members in year X



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Conclusions: Turnover

- Membership growth and stability
 - Average number of members has been relatively stable, decreasing slightly, over the last 5 years; ~16 members/center
 - Member turnover rate is at a new normal of 15-20% over the last 10+ years
 - However, this years much higher rate of 25% is likely due to a) COVID-19 economic uncertainties b) rising number of NCE sites
- Membership is dynamic
 - Program level picture positive based on continuous growth in new centers and sites
 - Most fluctuations attributable to initiation of Phase 3 funding opportunity and graduation of Phase 3 mega-centers
 - Membership picture is volatile
 - Causal factors are hard to pin down
 - Explanations may reside with center level variables like leadership, technology salience, as well as structural issues like the churn of old and new centers, site transitions, etc.
 - Useful both as a measure of overall program health and to benchmark center performance relative to program level norms



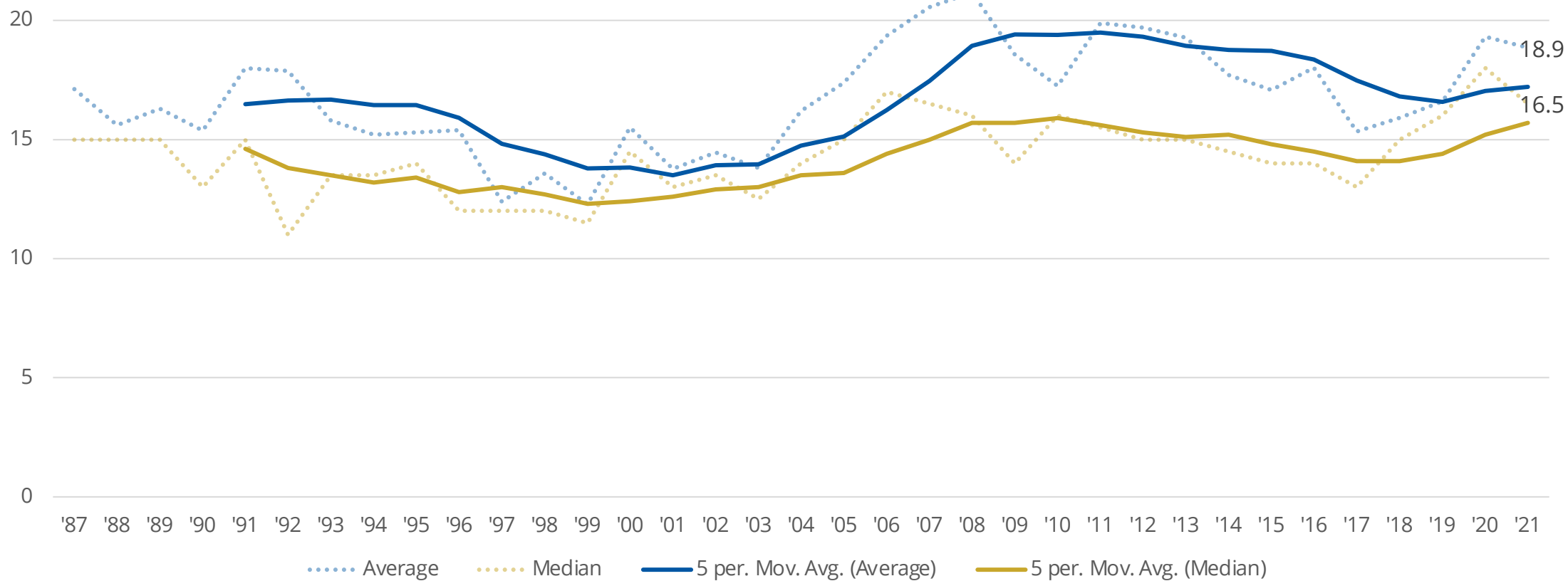
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Outputs and Outcomes



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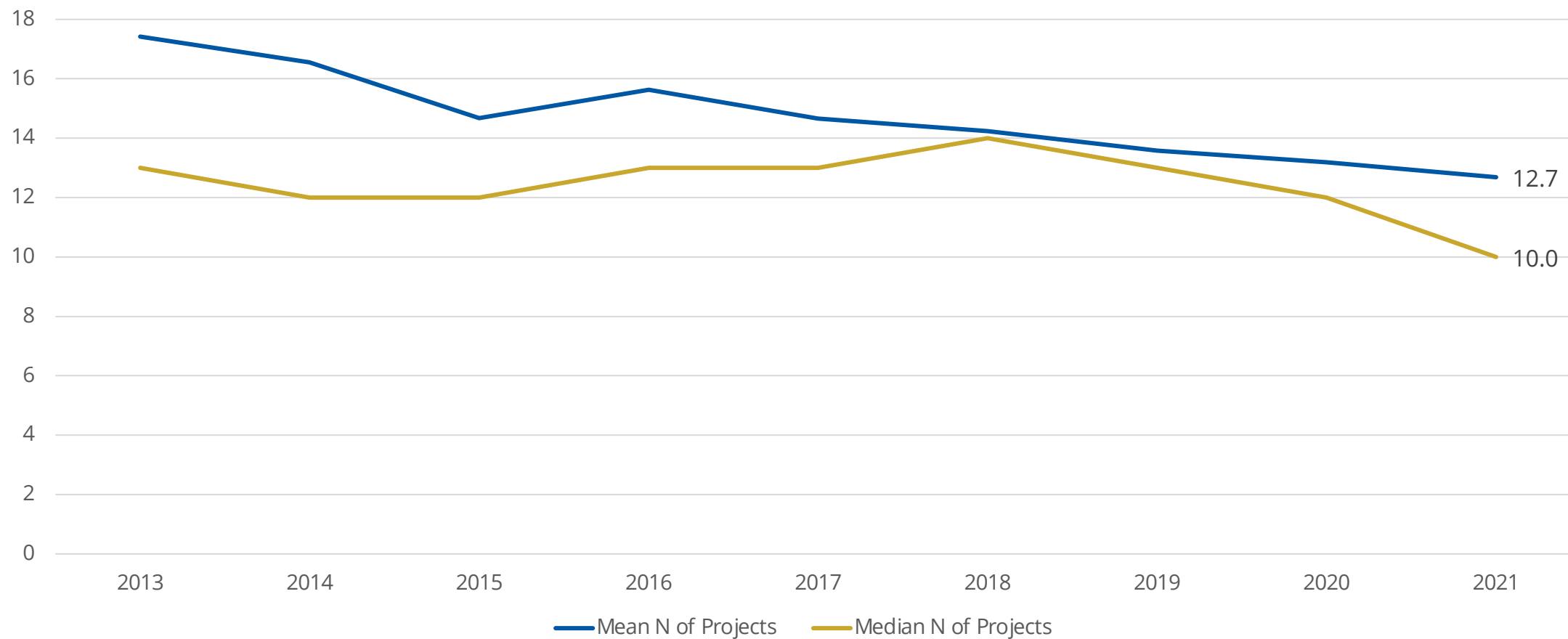
Number of Researchers per Center by Year





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Number of Center Funded Projects per Center by Year

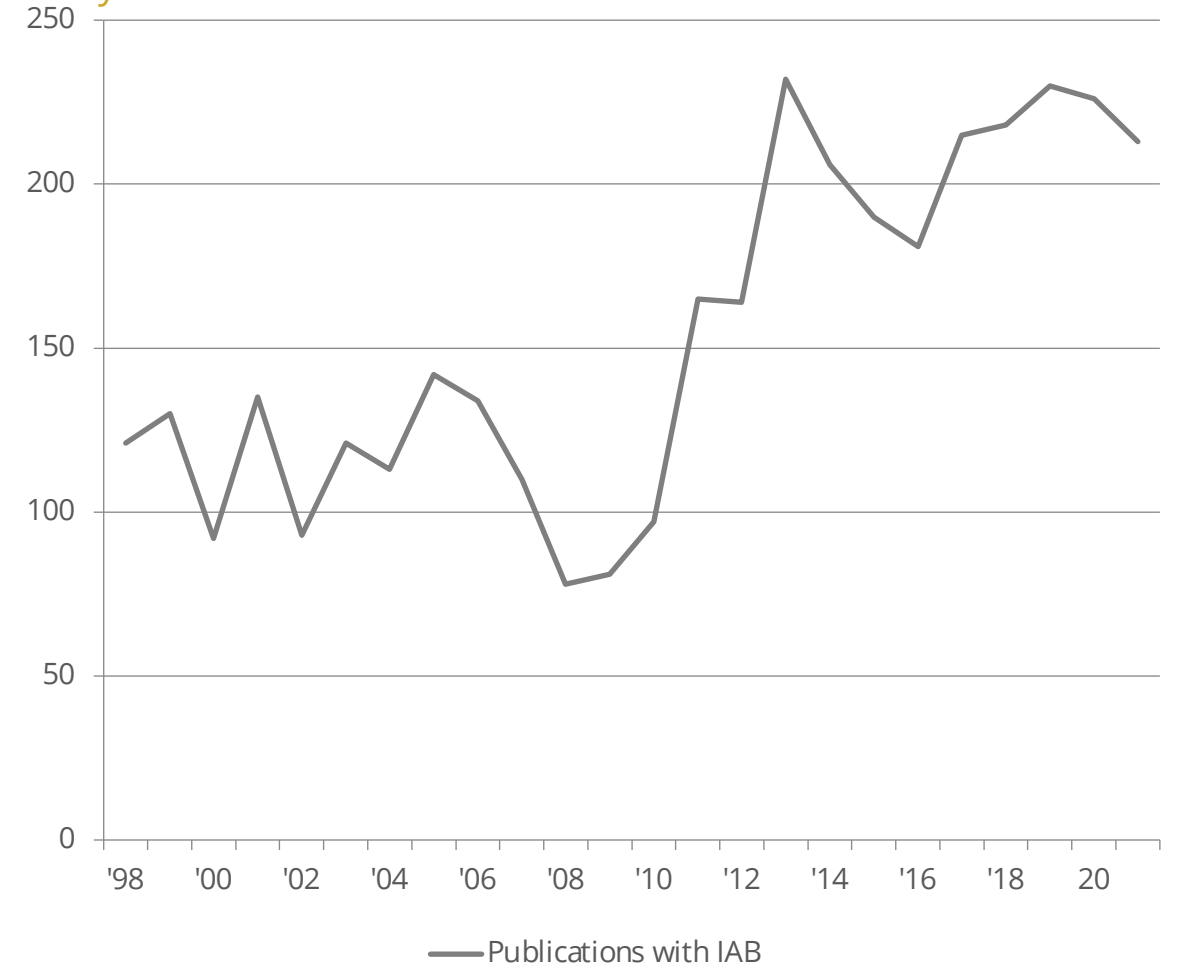


Total Number of Intellectual Property Events by Year



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Please note
the y-axis

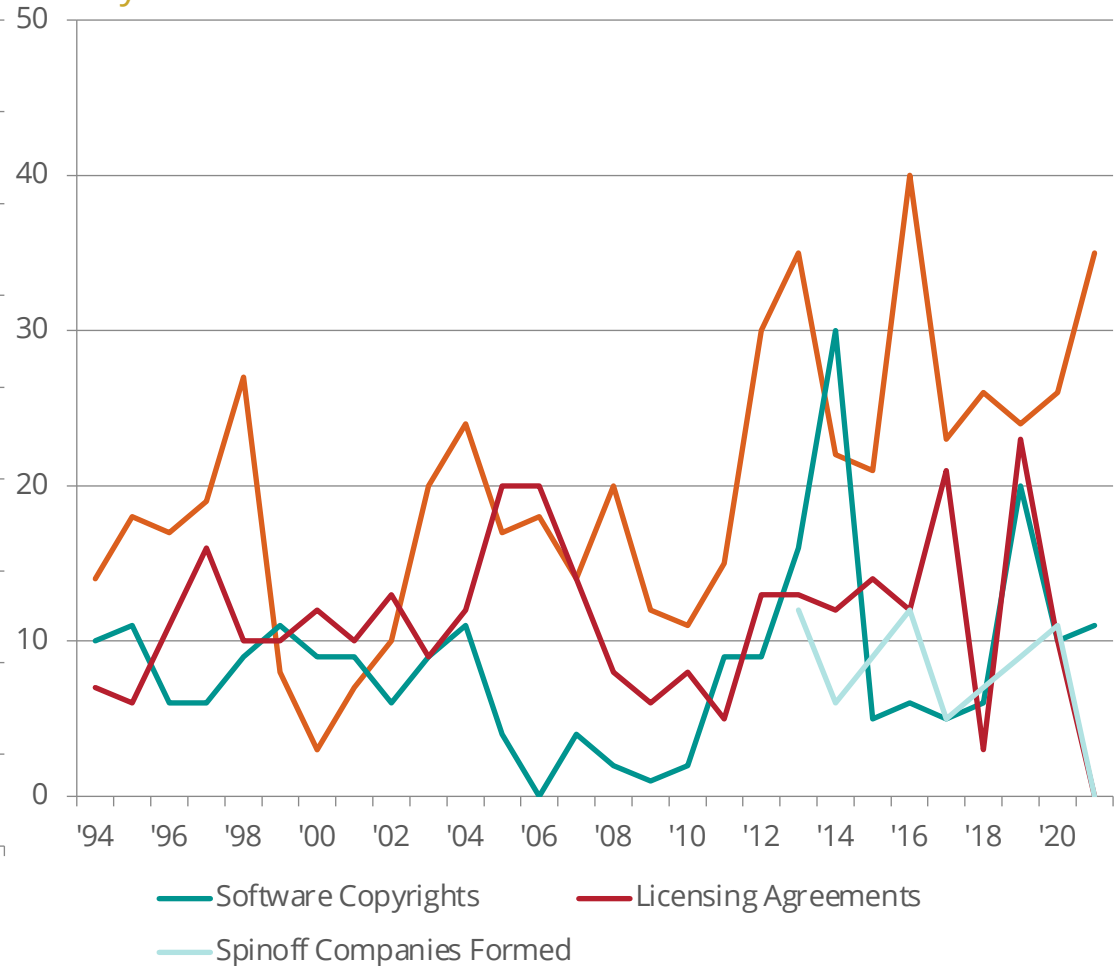
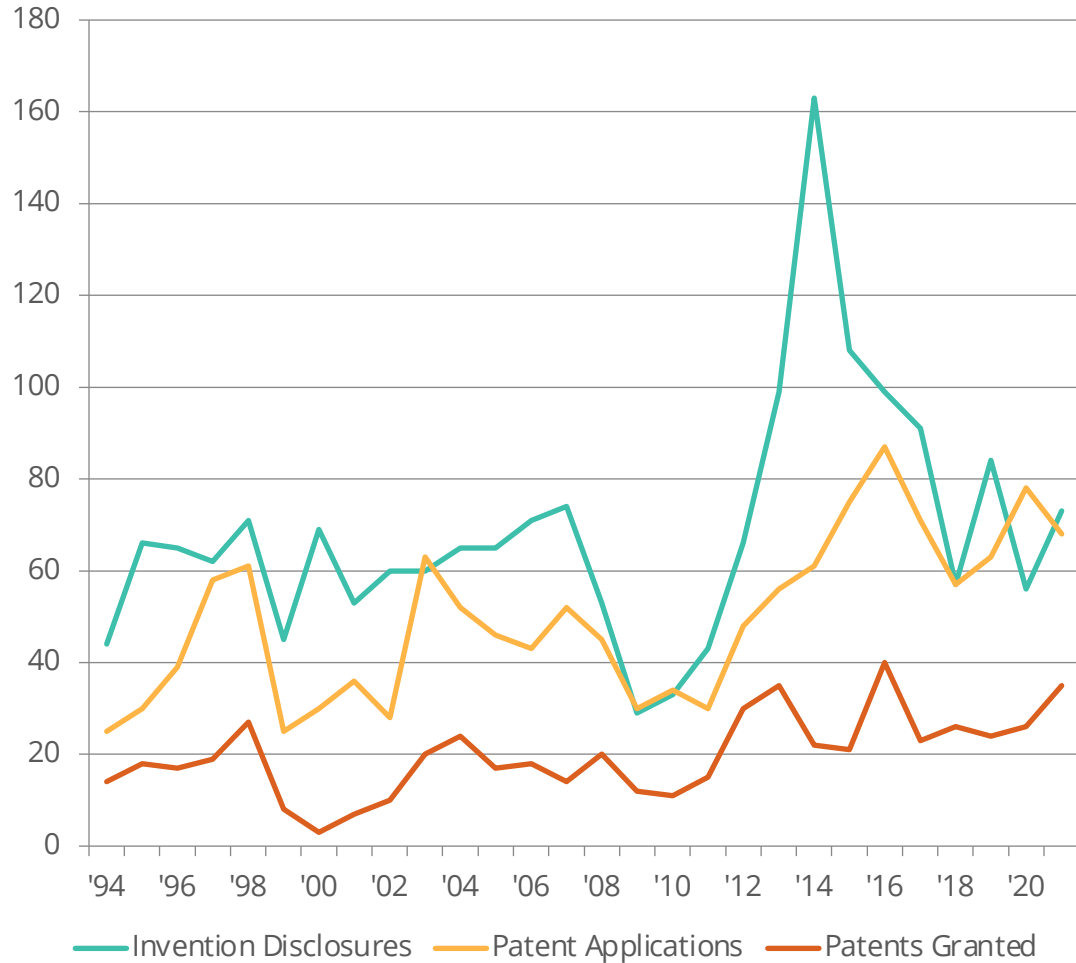


Total Number of Commercialization Events by Year



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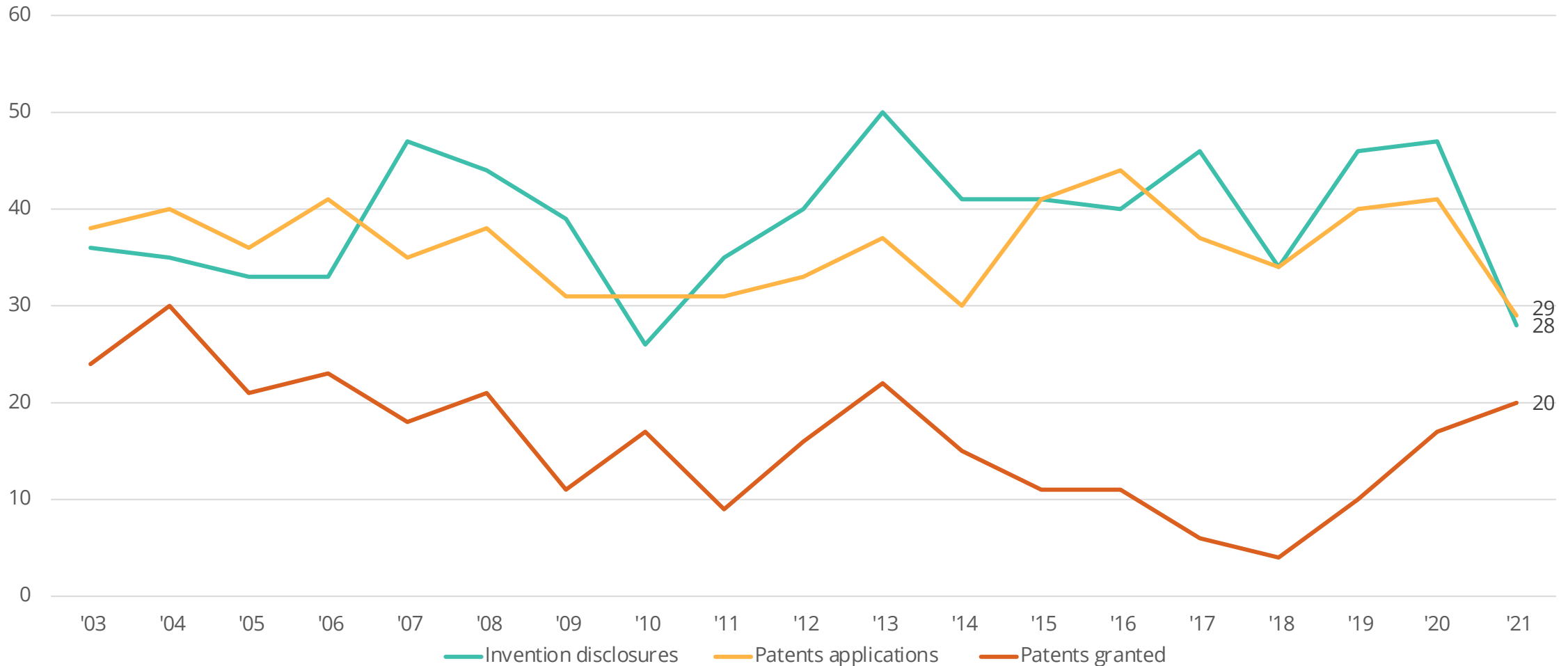
Please note
the y-axis



Percentage of Centers Reporting Commercialization Events by Year



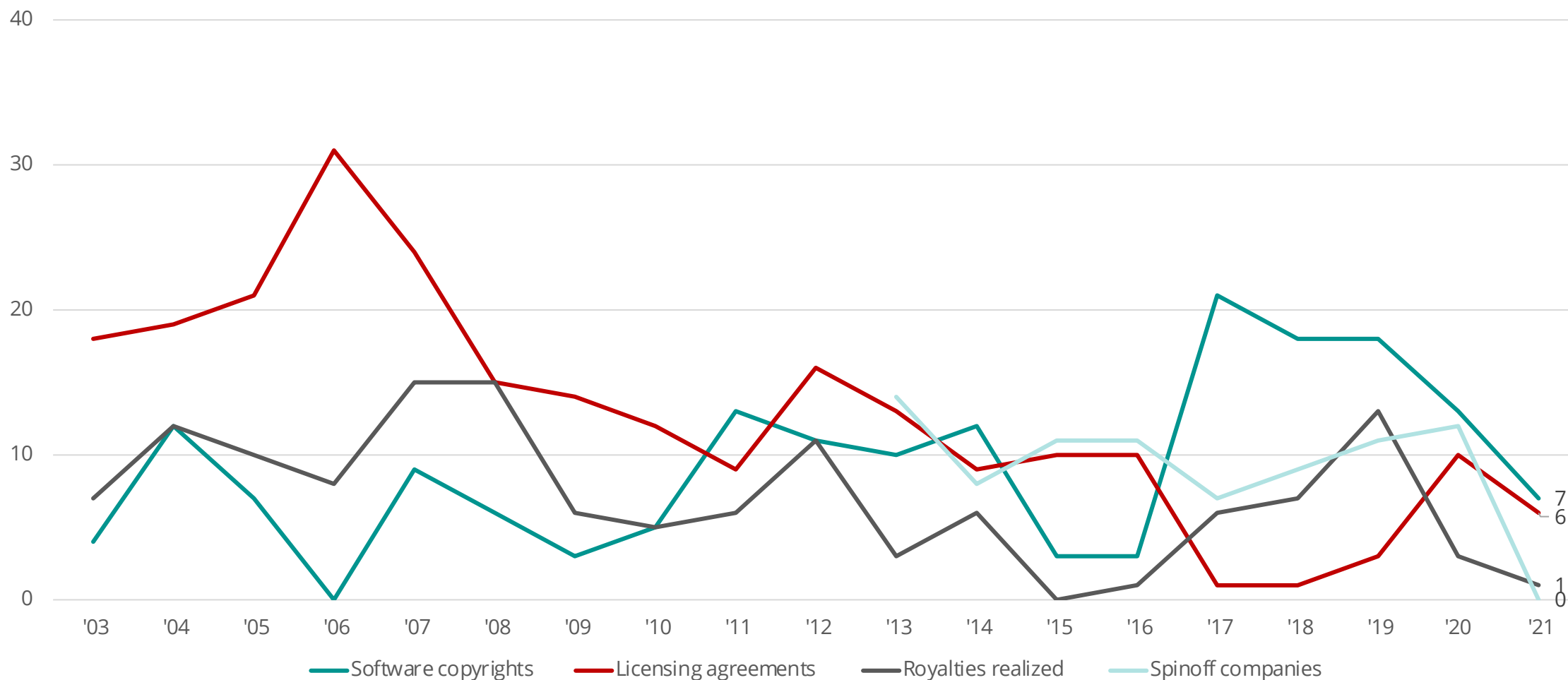
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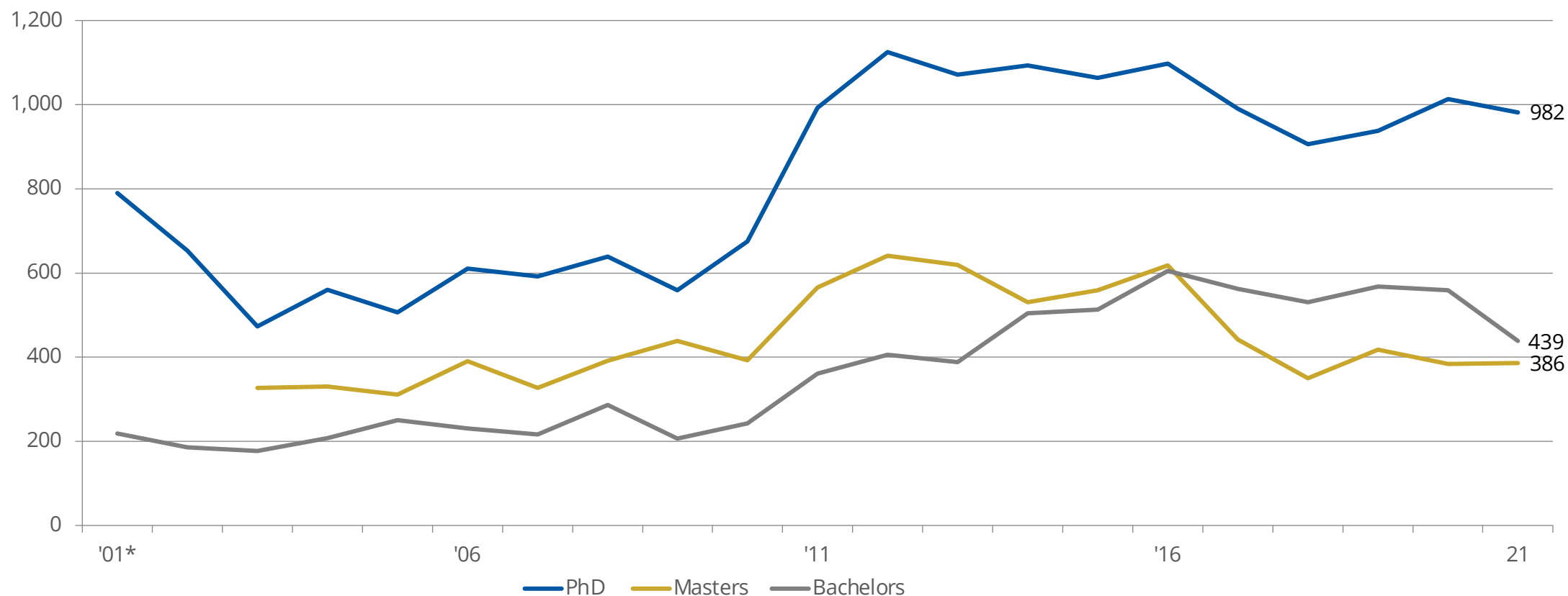
Percentage of Centers Reporting Commercialization Events by Year





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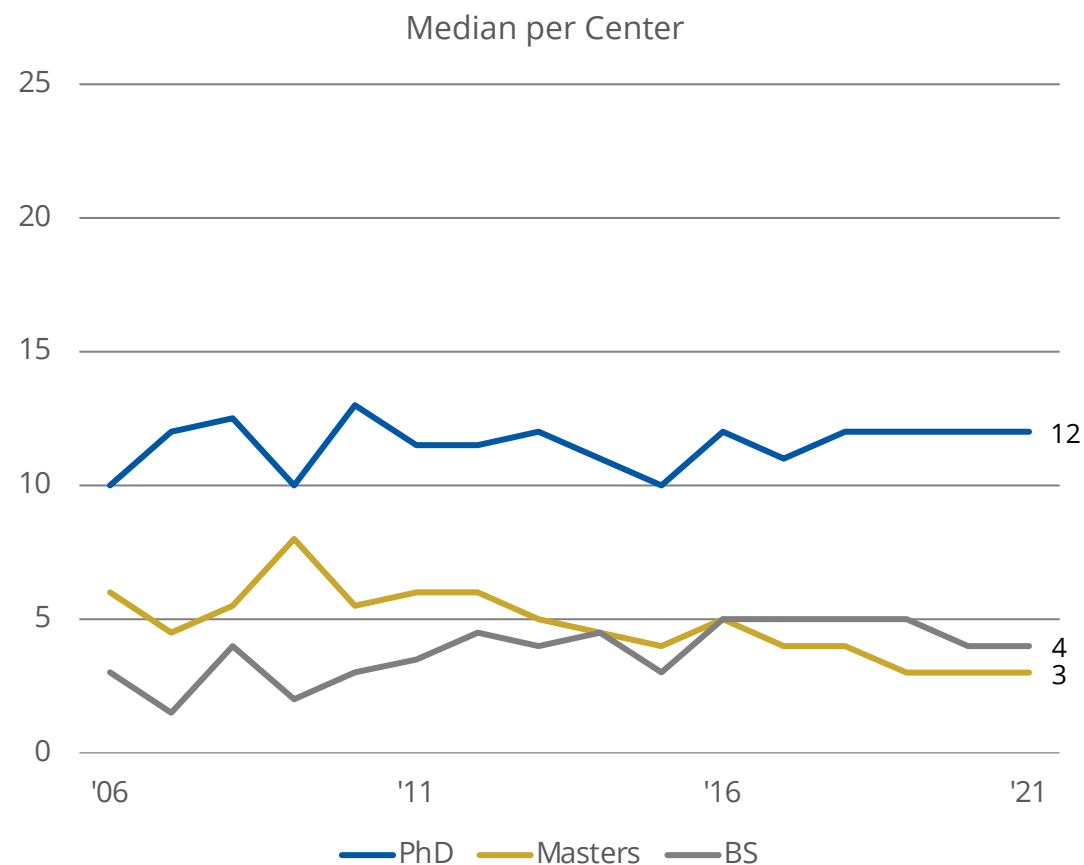
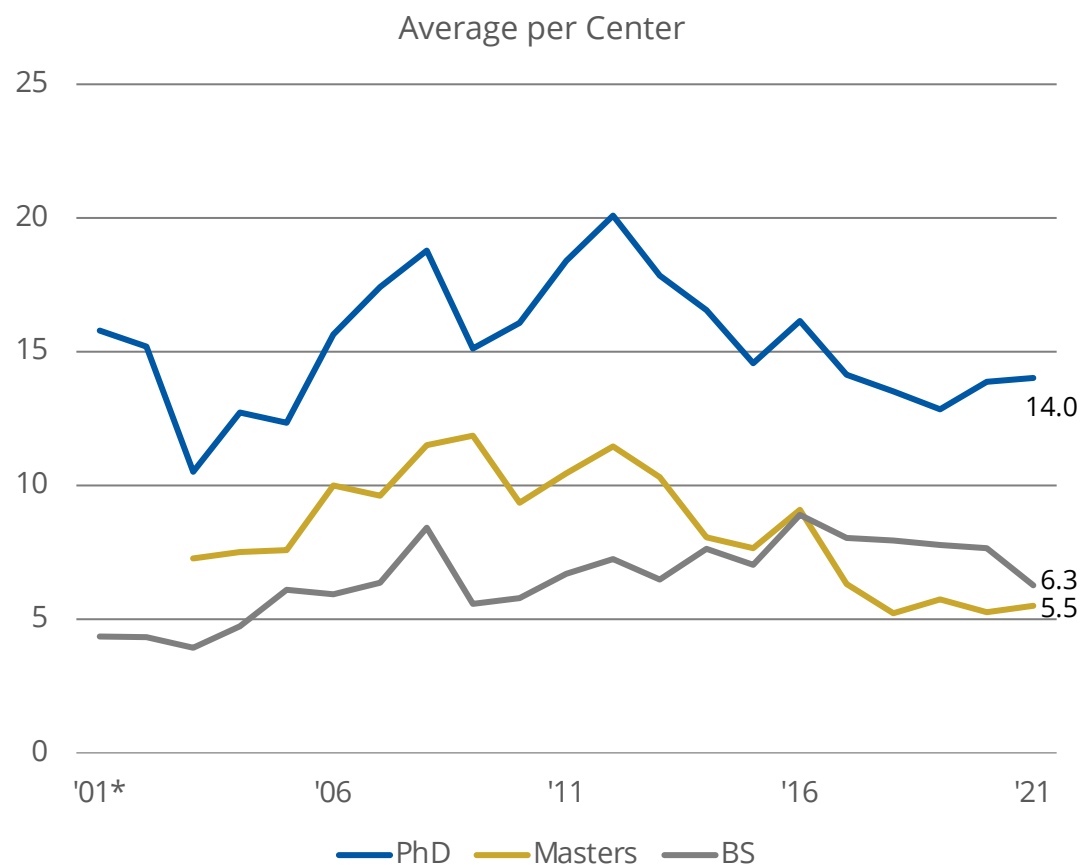
Total Number of Students Trained by Year





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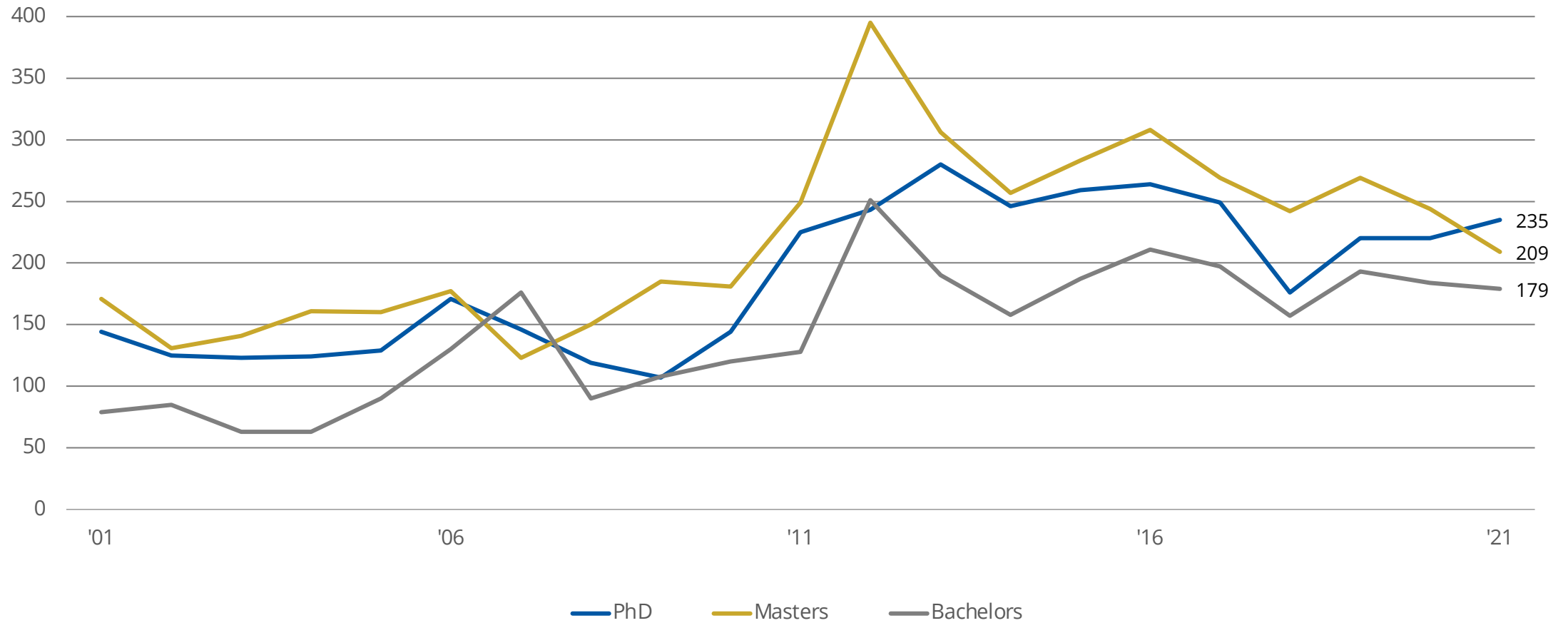
Students Trained per Center by Year



Total Number of Students Graduated by Year



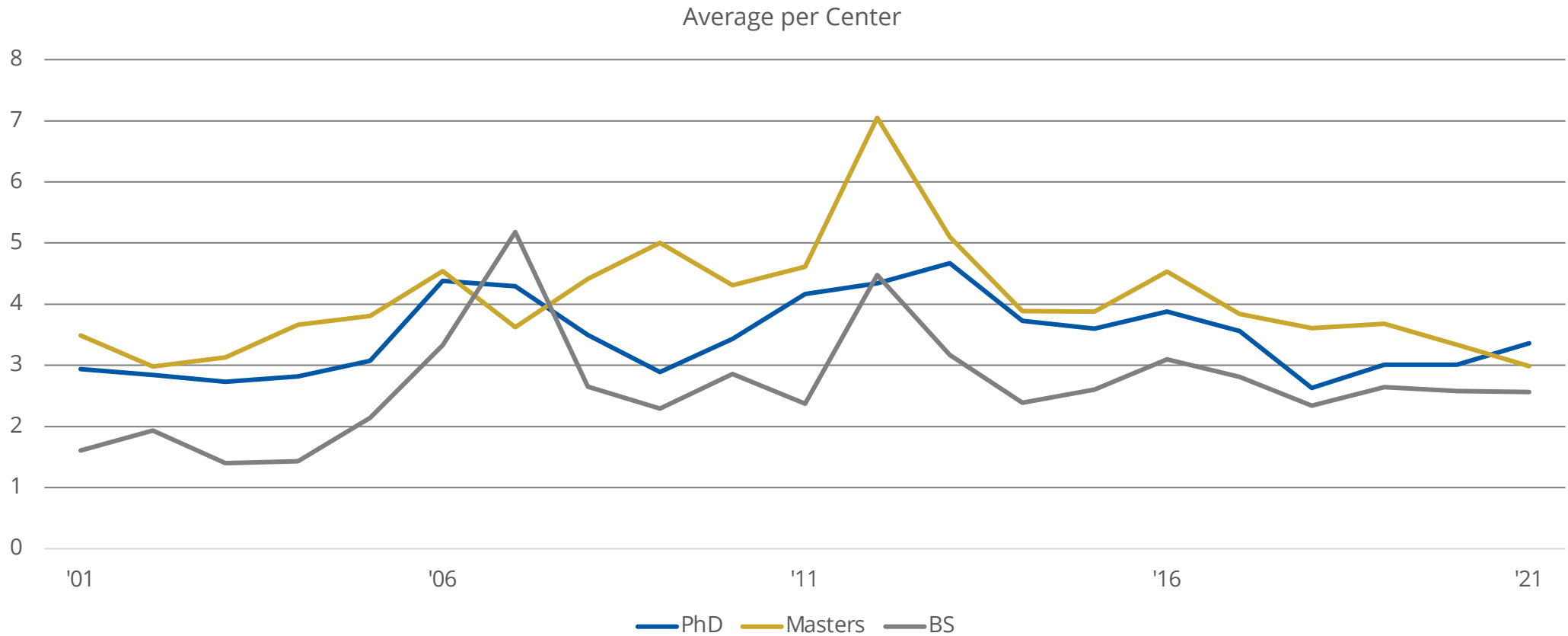
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Number of Students Graduated per Center by Year



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Total Graduates Hired by Industry & Government Members by Year



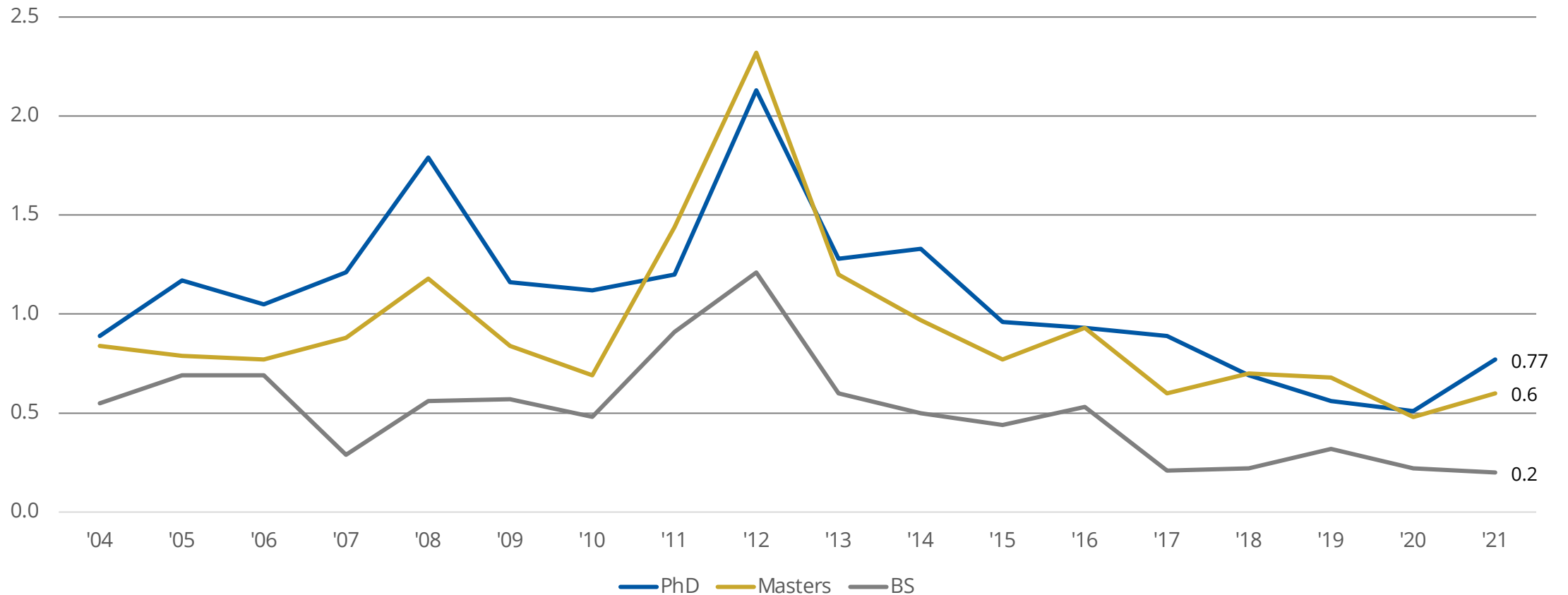
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Average Graduates Hired by Industry & Government Members



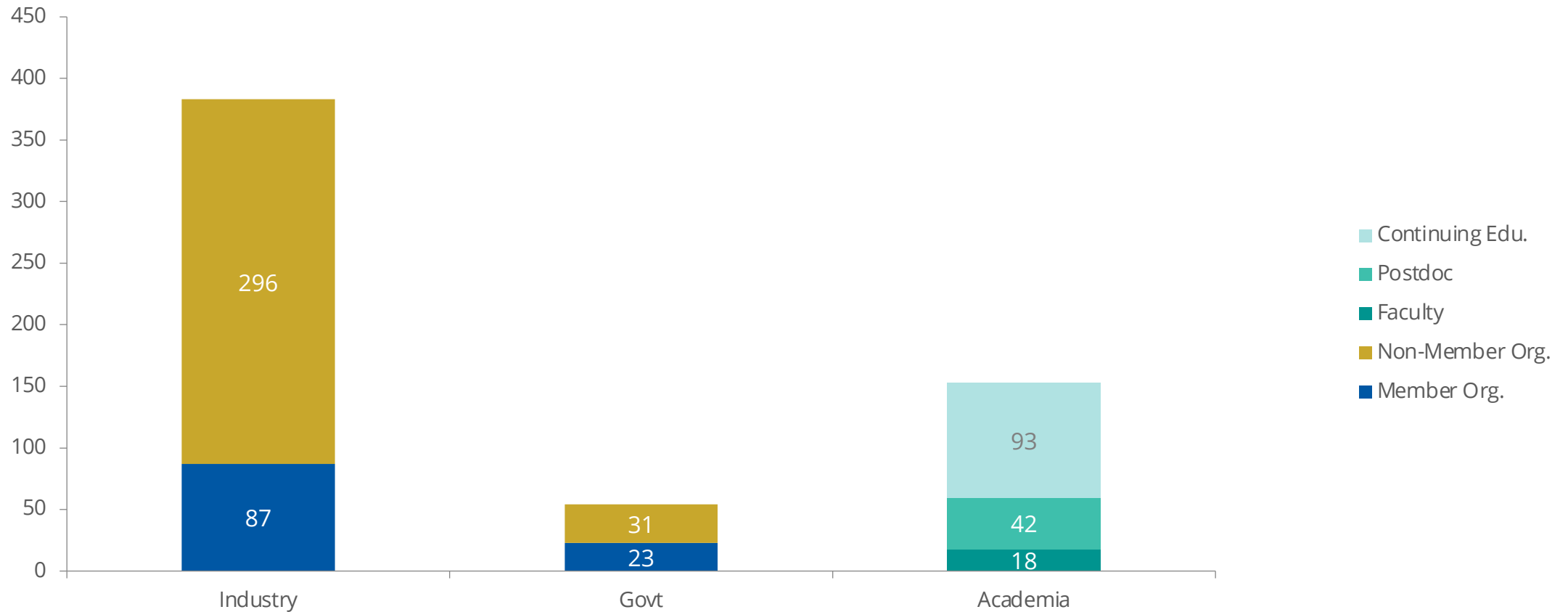
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IUCRC Alumni Career Outcomes: Total Number of FY2021 Graduates Hired



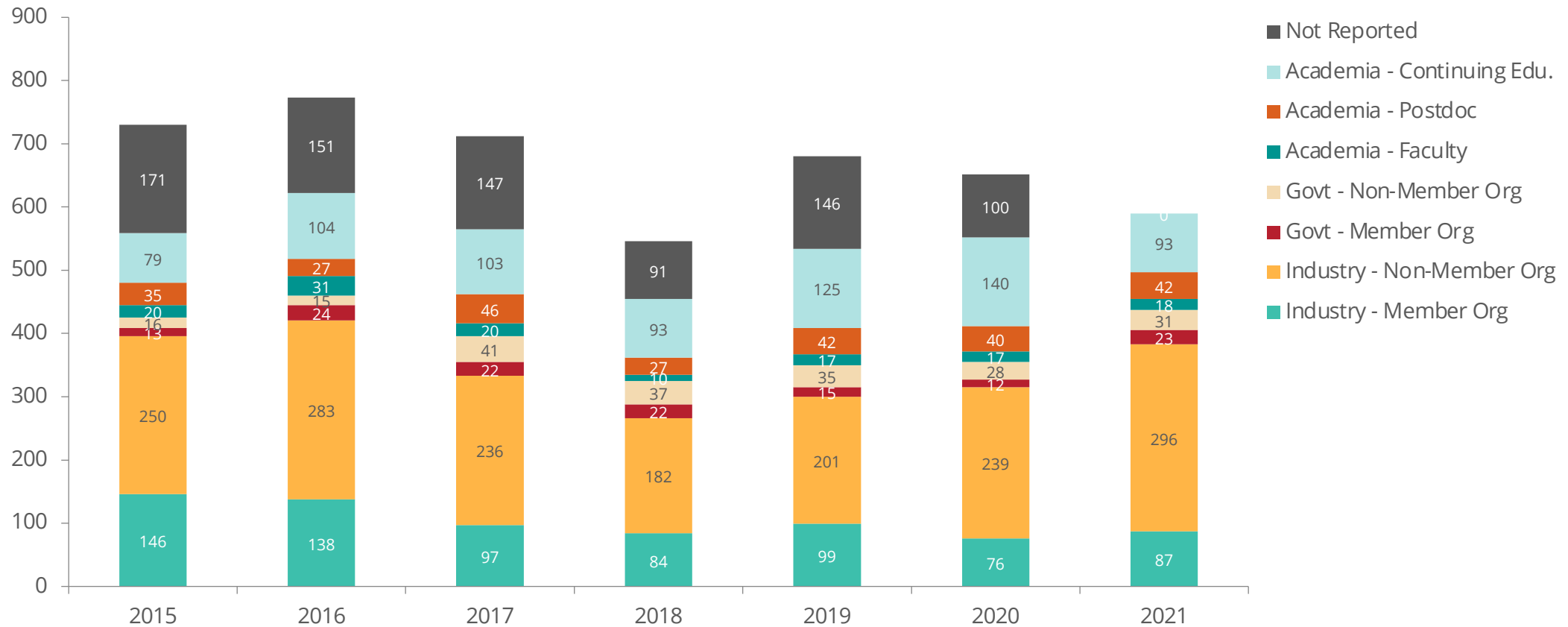
Industry/University
Cooperative Research
Centers



IUCRC Alumni Career Outcomes: Total Number of Graduates Hired Over Time



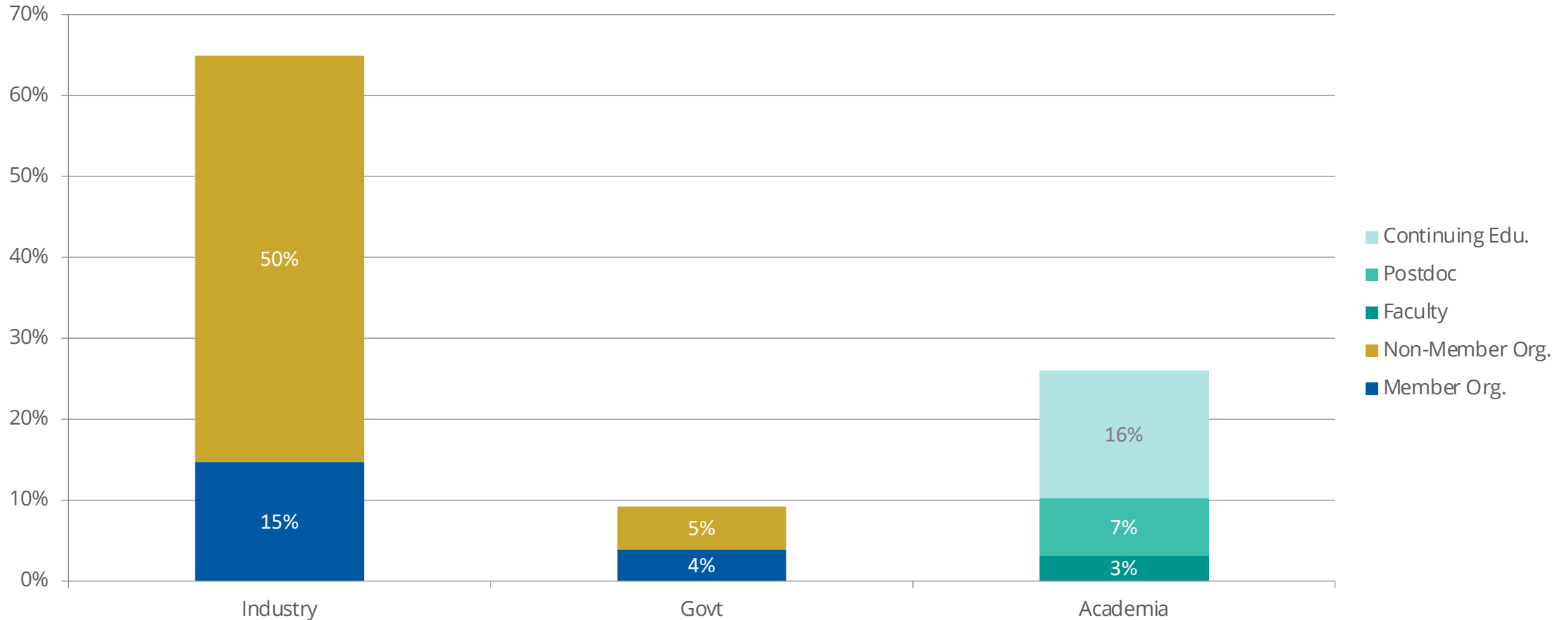
Industry/University
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IUCRC Alumni Career Outcomes: Percent of FY2020 Graduates Hired



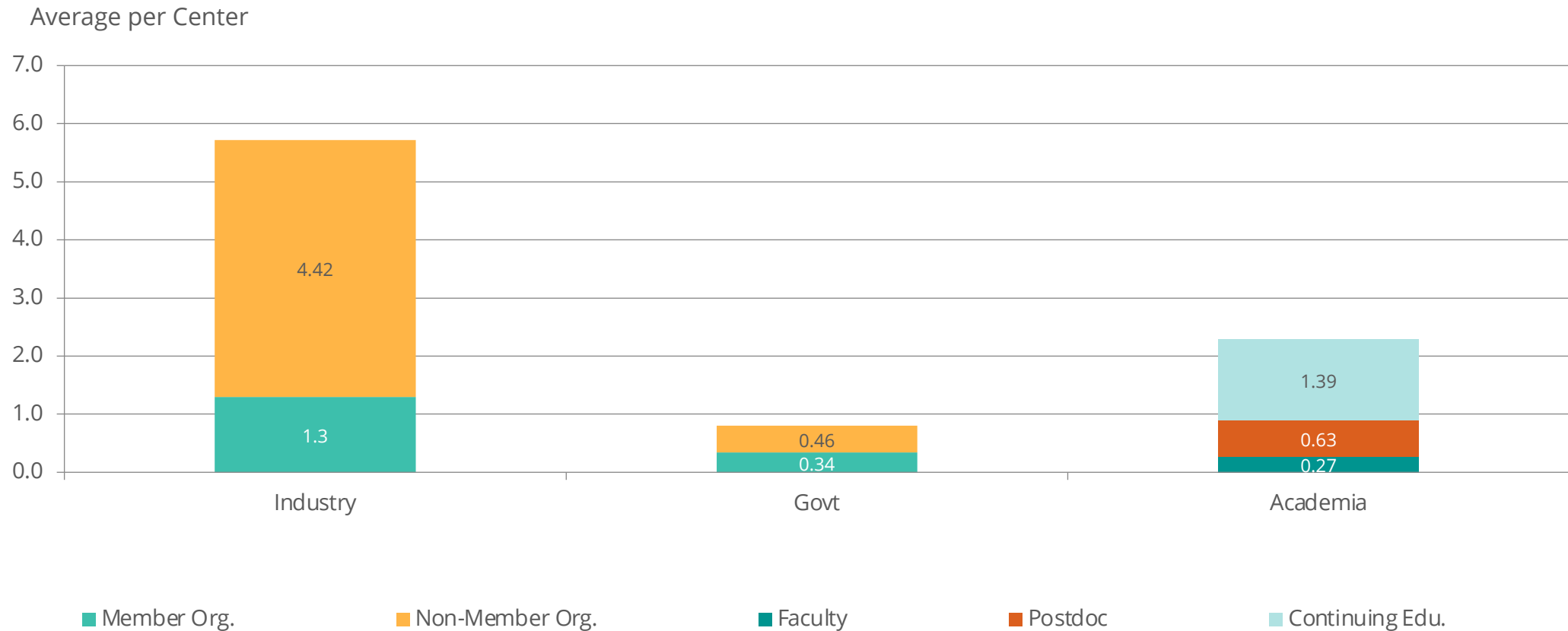
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IUCRC Alumni Career Outcomes: Number of FY2021 Graduates Hired per Center



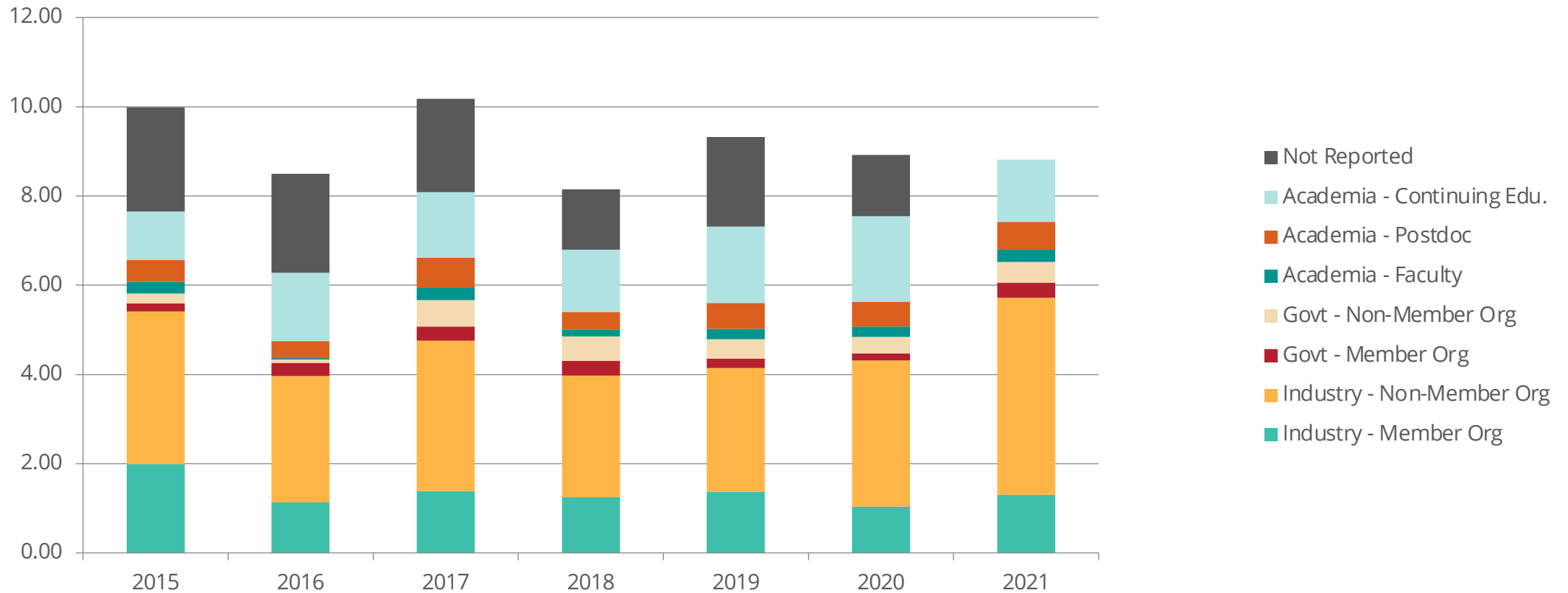
Industry/University
Cooperative Research
Centers



IUCRC Alumni Career Outcomes: Average Number of FY2020 Graduates Hired per Center Over Time



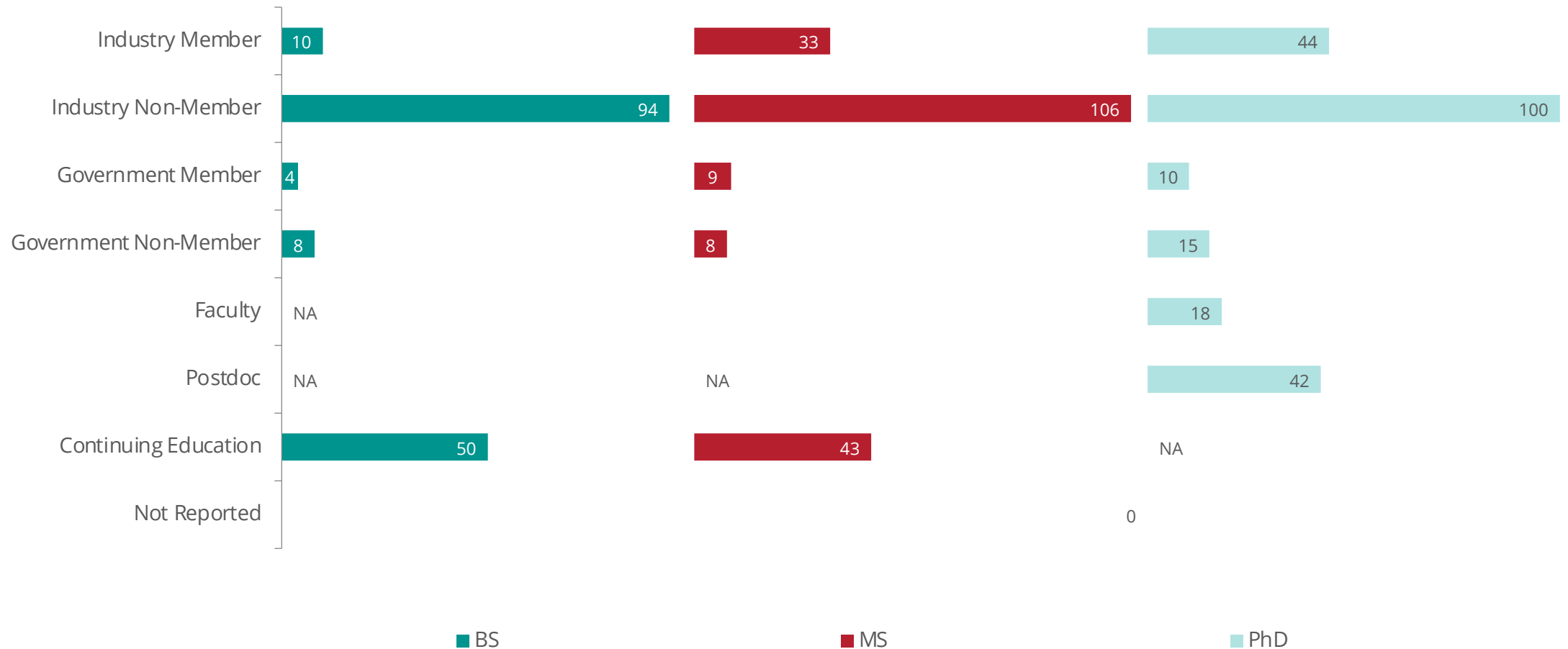
Industry/University
Cooperative Research
Centers



IUCRC Alumni Career Outcomes: Total Number of FY2021 Graduates Hired by Degree Level



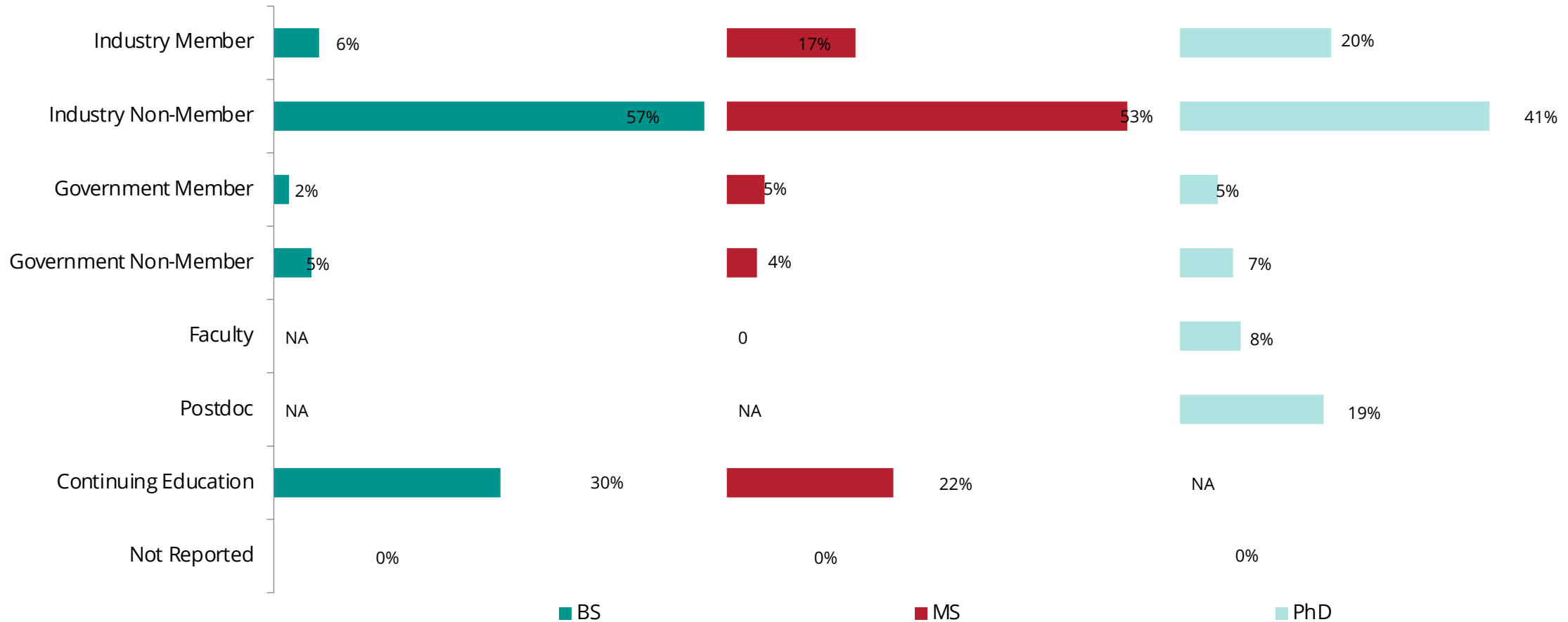
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Cooperative Research
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IUCRC Alumni Career Outcomes: Percent of FY2020 Graduates Hired by Degree Level



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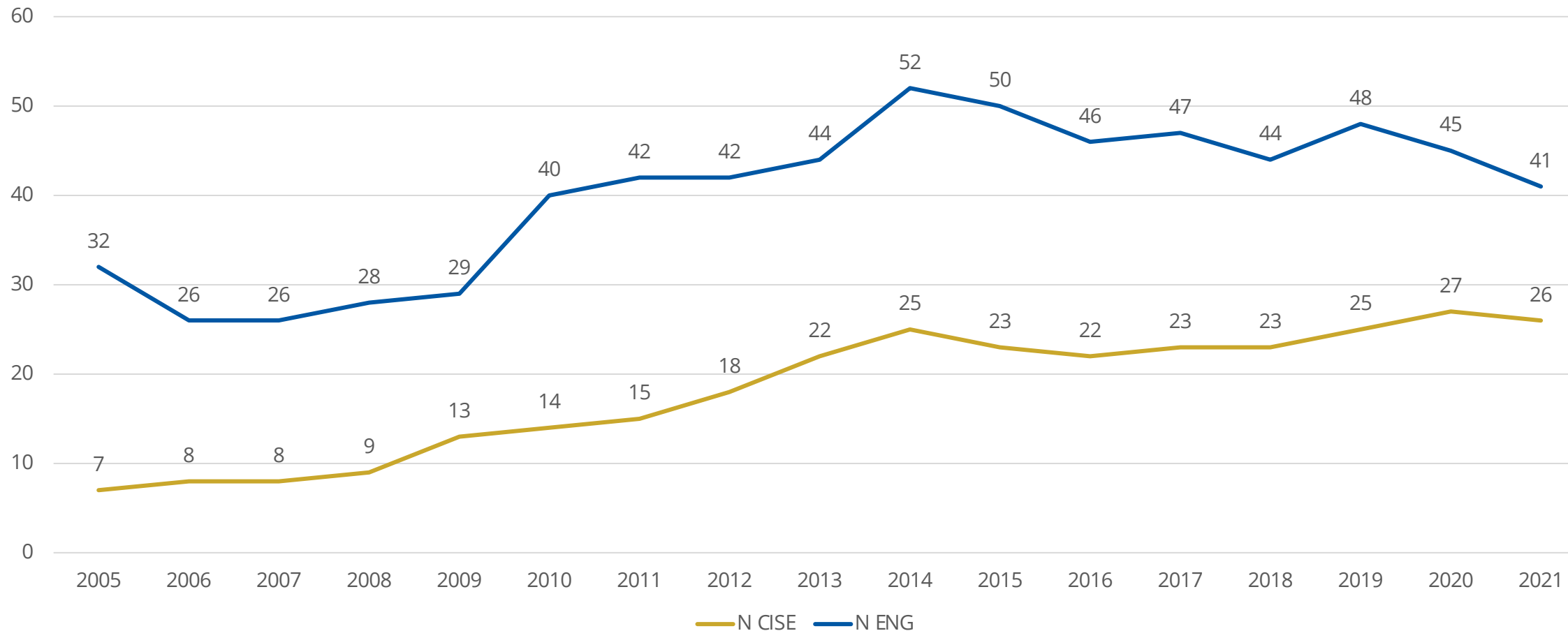
CISE & ENG Partnership

Some Comparisons and Recent Trends



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Cooperative Research
Centers

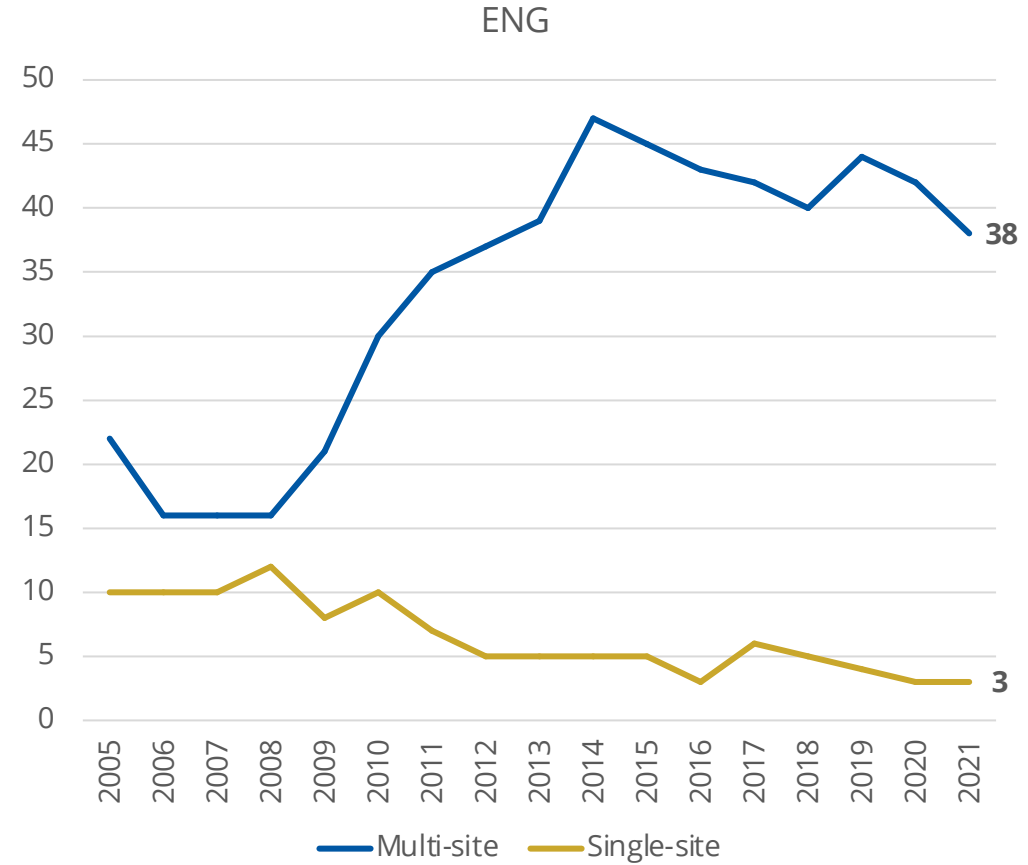
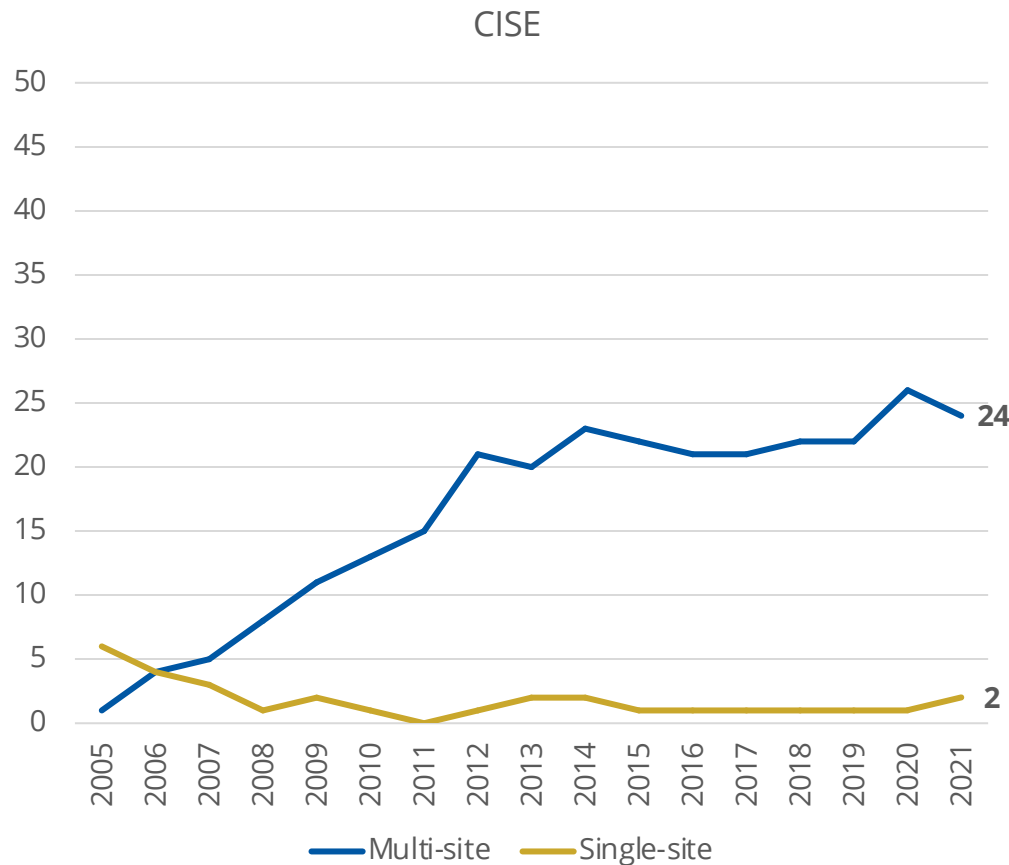
Number of CISE & ENG Centers by Year



Both Directorates Have Had Multi-site Centers Increase and Single-Site Centers Decrease



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Cooperative Research
Centers

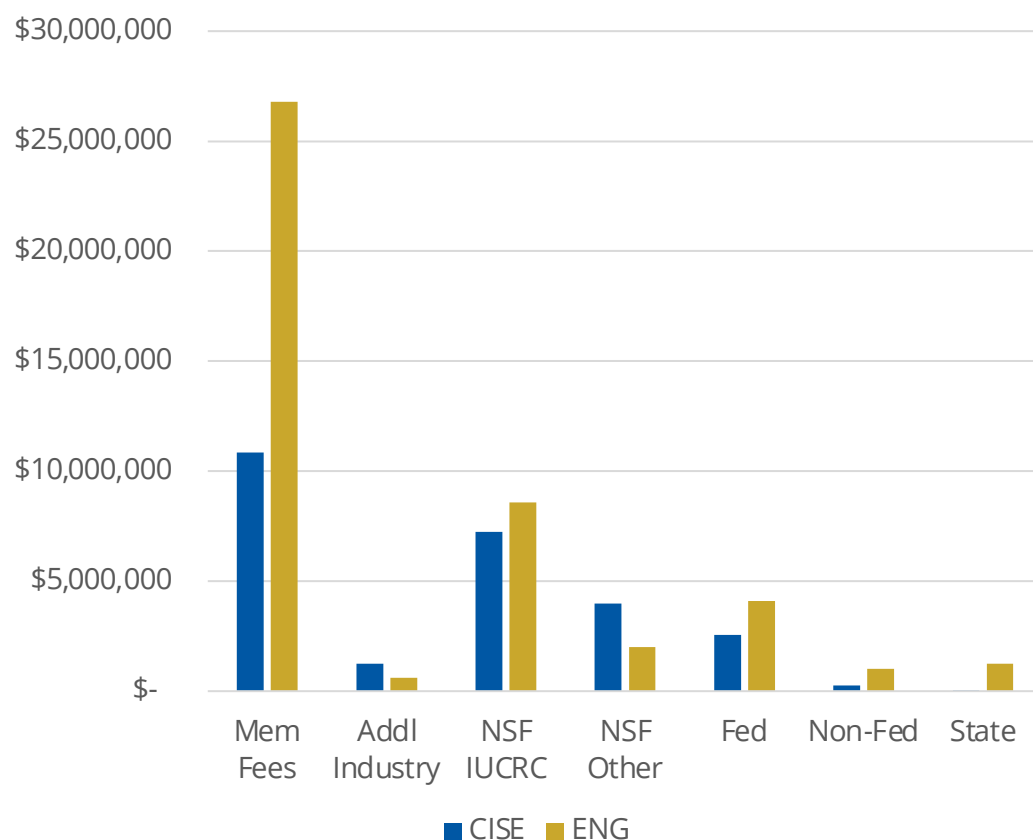




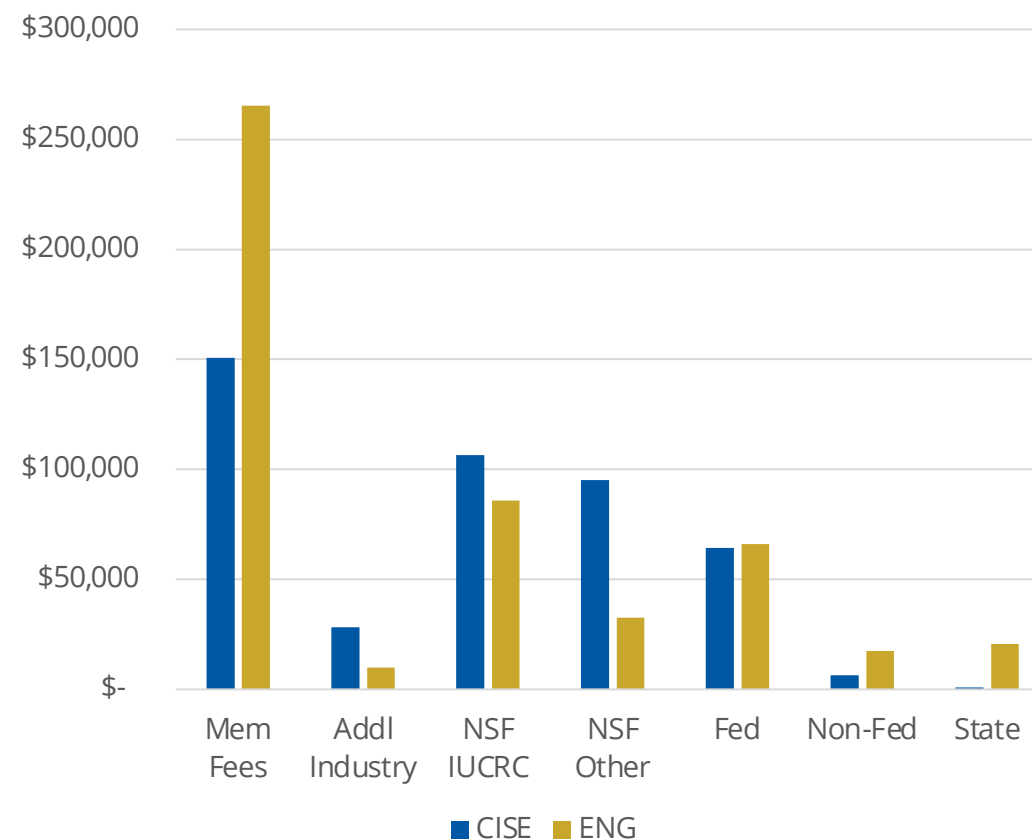
Industry/University
Cooperative Research
Centers

FY2021 CISE & ENG: Funding by Source

Total Dollars



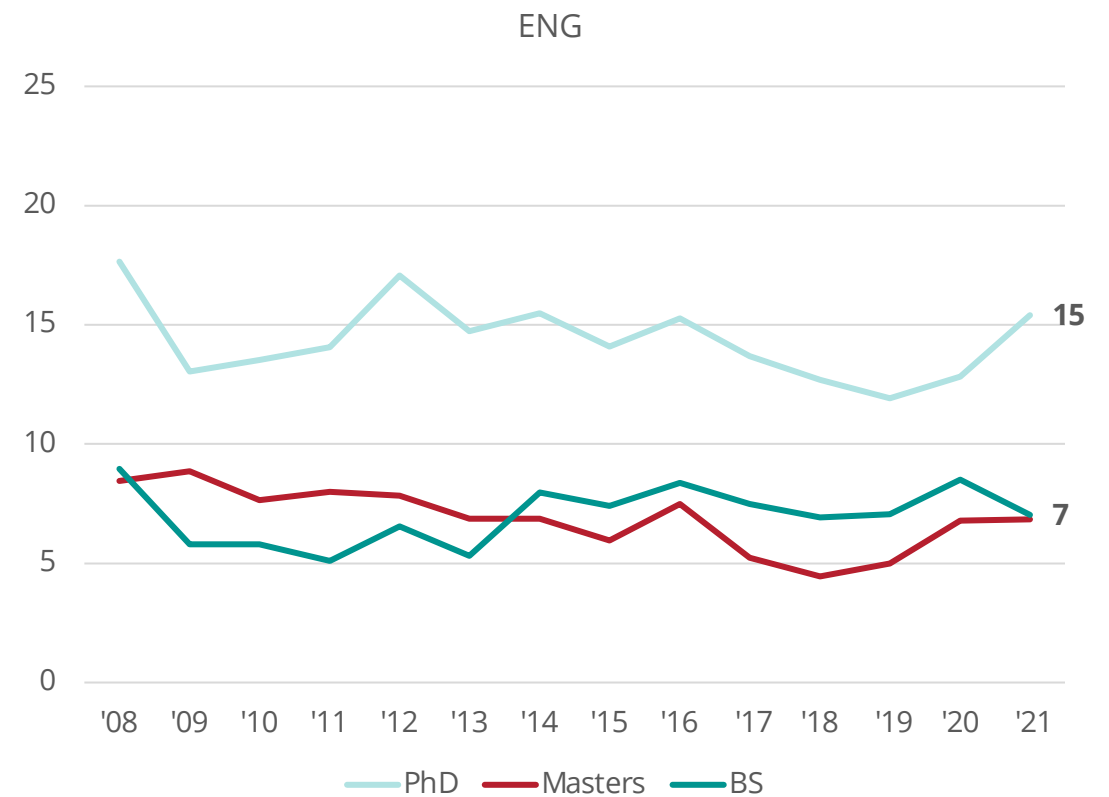
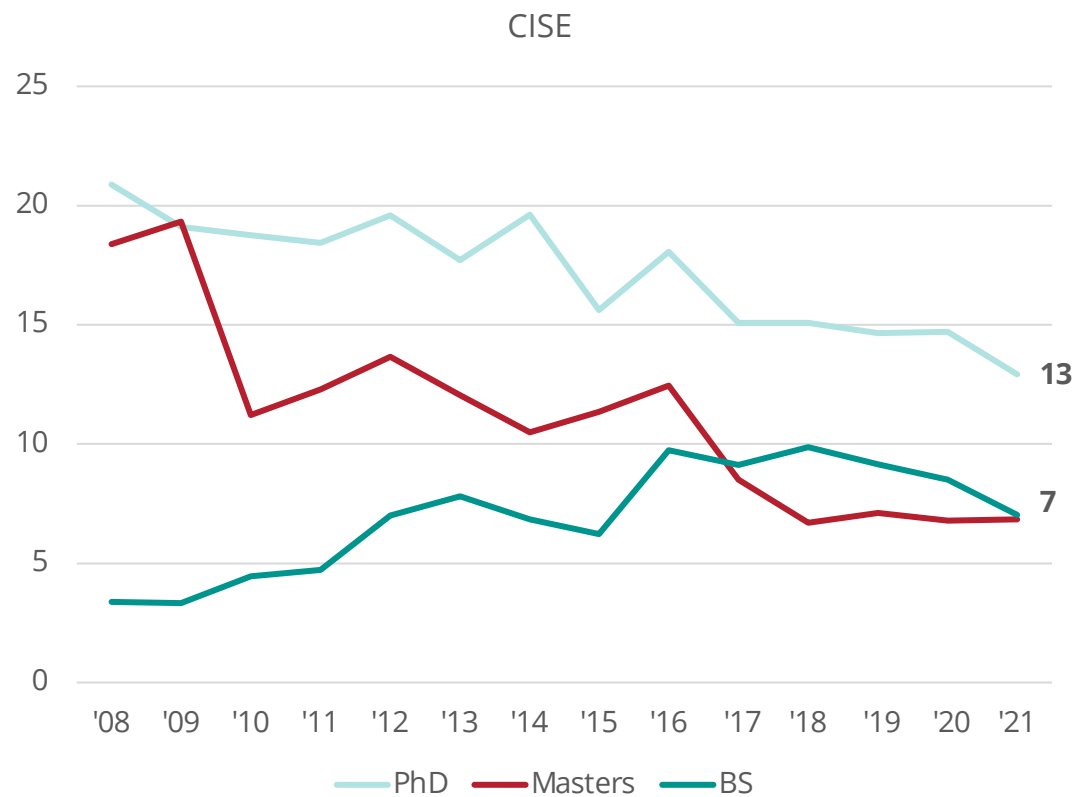
Average Dollars



CISE & ENG: Average Number of Students Trained per Center by Year



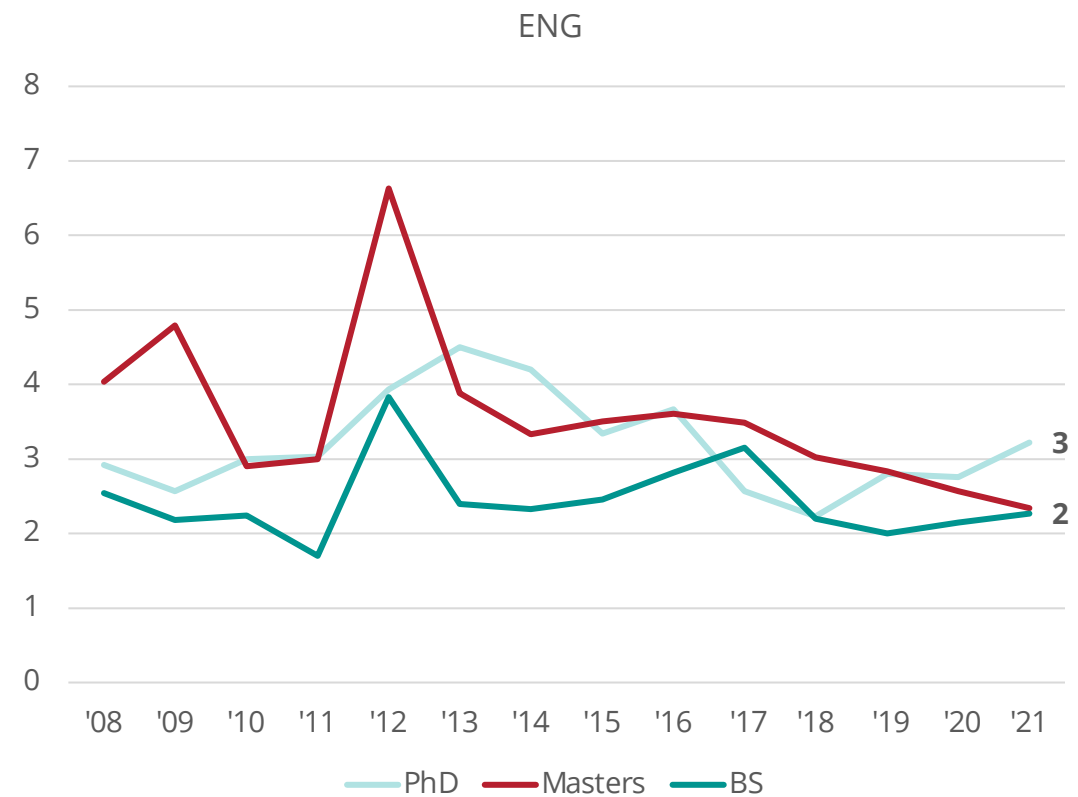
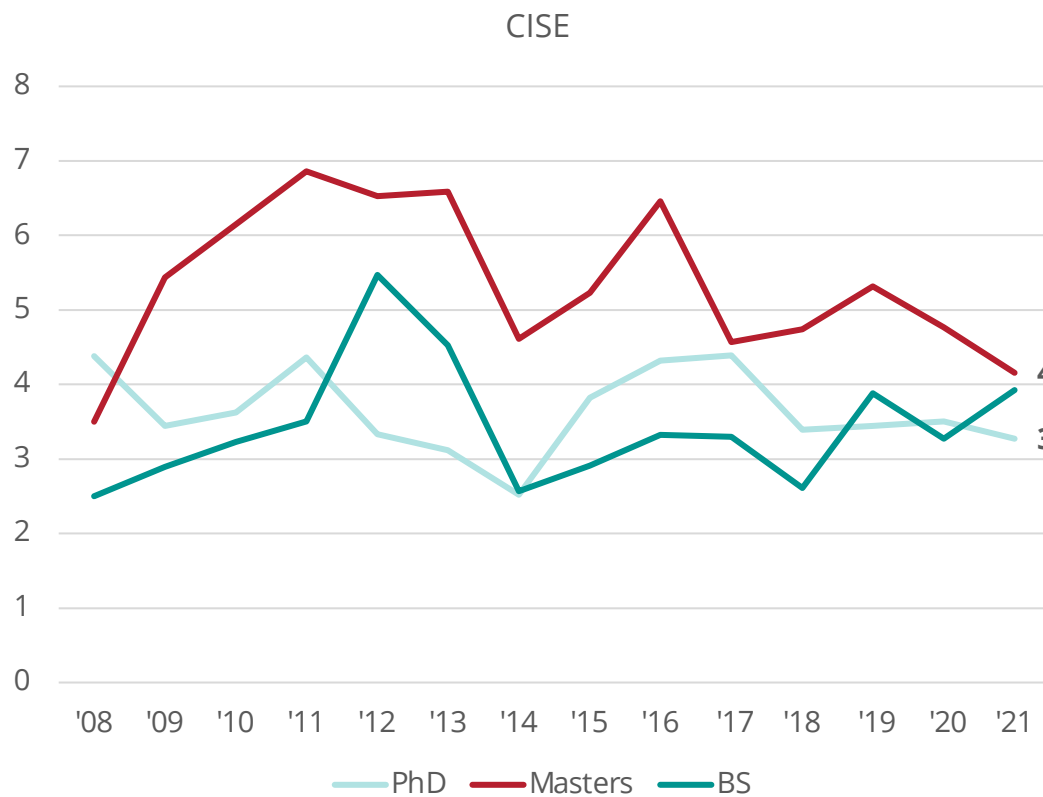
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CISE & ENG: Average Number of Students Graduated per Center by Year



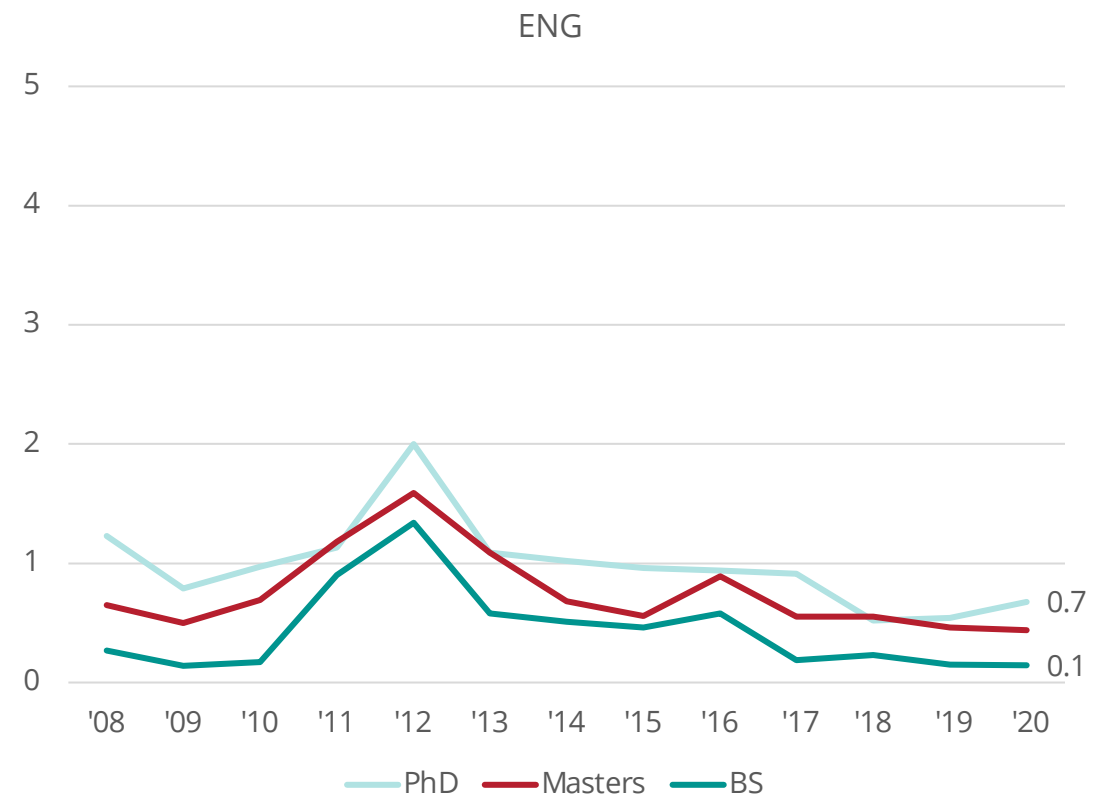
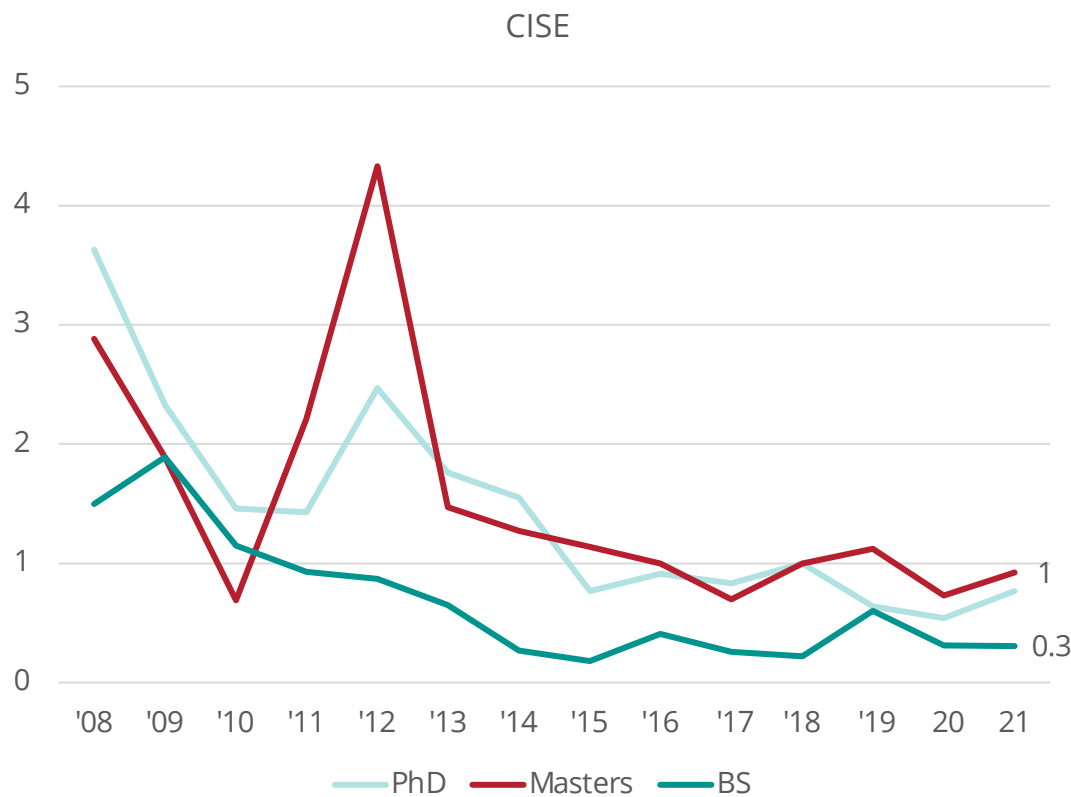
Industry/University
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CISE & ENG: Average Number of Students Hired by Members Per Center by Year



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Cooperative Research
Centers



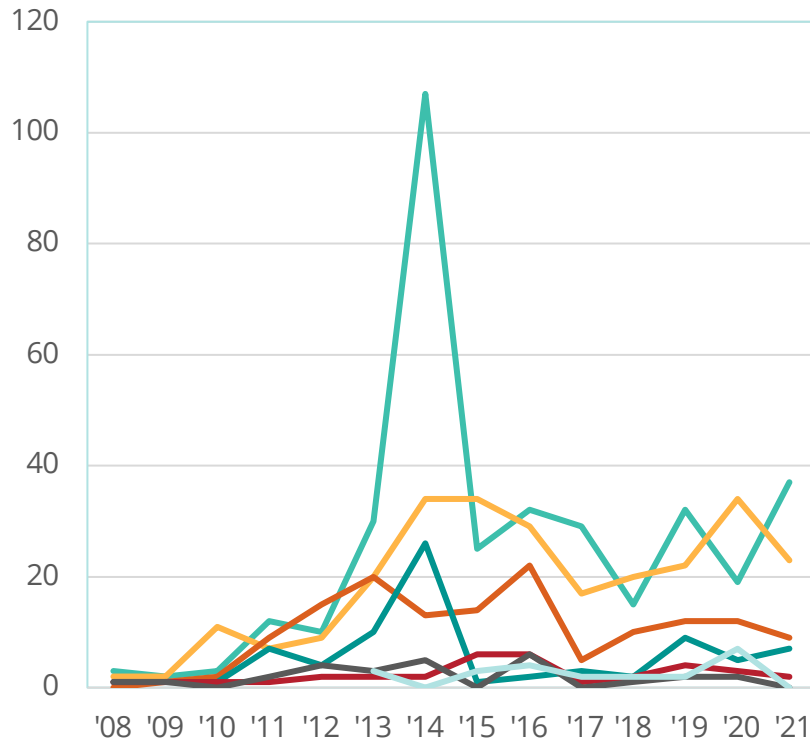
CISE & ENG: Total Number of Intellectual Property & Commercialization Events by Year



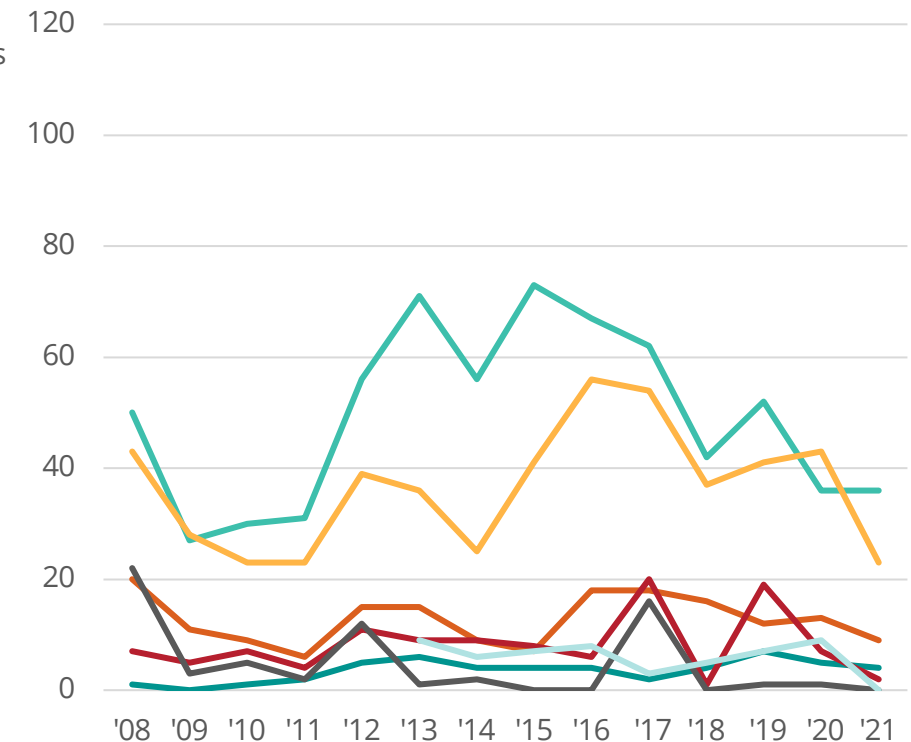
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Cooperative Research
Centers

CISE

ENG



- *Invention Disclosures
- Patent Applications
- Patents Granted
- Software Copyrights
- Licensing Agreements
- Royalties Realized
- Spinoff Companies Formed

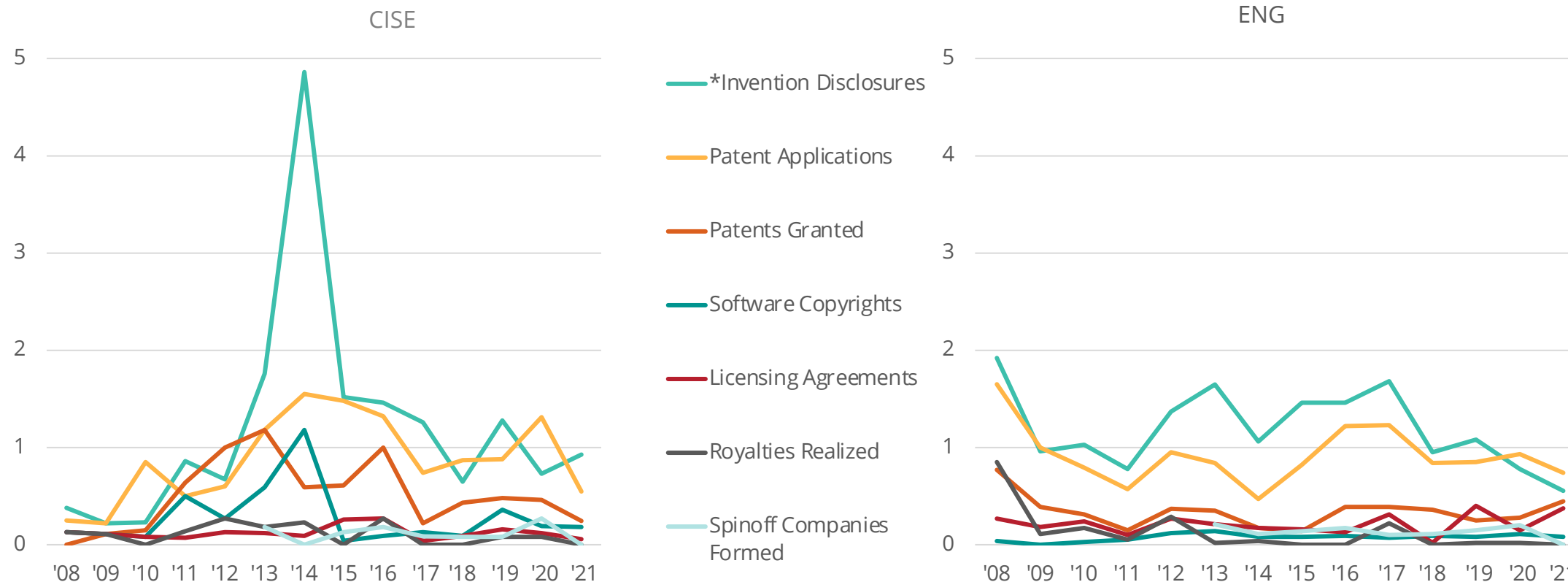


*Invention Disclosures Outliers: CISE 2014: CVDI = 40, CITeR = 17, E-Design = 12.

CISE & ENG: Average Intellectual Property & Commercialization Events



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*Invention Disclosures Outliers: CISE 2014: CVDI = 40, CITeR = 17, E-Design = 12.