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MassVision2050

Software

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MASSACHUSETTS
HIGHTECHNOLOGYCOUNCIL

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Definition of Software

The software industry encompasses a vast range of products and services and is primarily divided into enterprise and consumer segments. Within each segment, software can be further differentiated by a) functional layer, b) delivery method, or c) targeted buyer / end user.

This includes products ranging from highly generalized mass market productivity apps hosted on public clouds, to very niche, industry and segment-specific offerings delivered via on-premises private clouds.

Approach to quantifying market share and economic competitiveness:

- Analyze the landscape of organizations within the enterprise and consumer Software spaces and the roles for which they are hiring¹
- Aggregate job postings and professional profiles that employ key Software related roles including:
 - Software Publishers
 - Computer Systems Design Services
 - Data Processing, Hosting and Related Services
 - Custom Computer Programming Services
- Review VC investment in new and growth-focused software ventures across MA and the rest of the US
- Identify notable startups and exits in the Software innovation space

1. Captured as NAICS codes 511210, 541512, 518210 and 541511

Executive Summary: Software

Preliminary

Macro trends

- The global B2B software market is projected to grow at 12% through 2027 reaching \$1.7 trillion, led by software infrastructure in terms of CAGR (13.3%) and horizontal software in terms of market size (\$704B)
- Scalable growth from high switching costs, captive customers, natural connections to other high-tech sectors, and compound effects across all 3 sub-segments – vertical, horizontal and infrastructure – make developer organizations excellent ecosystem growth catalysts
- Massachusetts houses one of the largest Software sectors in the country (4.5% of GDP and 3.3% of employment in the US), but other states are competing for growth (MA has a projected job growth of 0.8% from 2024-2029, compared to 3.0%+ in Texas and Colorado)
- The Software sector accounts 6.5% of the state's GDP and 3.8% of employment, a larger share of both GDP and employment than the US overall (3.2% and 2.2% in the US, respectively), however, growth in the Software sector in US overall has outpaced growth in MA (6.6% GDP growth in MA vs 8.7% in the US, 2014-24, 1.6% vs 3.8% employment growth)

Talent Supply and Demand

- Although MA produces enough graduates to fill open roles in many in-demand tech occupations, local employers must also compete on a national scale
- Nearly 24K Software-related degrees were granted in 2023, the number of Software degree graduates grew by 4.2% since 2018
- While postings for software jobs decreased from 2021 H1 to 2025 H2; demand for AI and related skills (machine learning, continuous improvement process, scalability) have increased substantially

Investments in Innovation

- MIT invests the most in computer and information sciences R&D among MA's higher ed institutions (\$120M, 2023), and ranks 5th nationally
- MA Software companies invested \$6.4B in R&D in 2022 (up from \$4.4B in 2021), MA ranks in the top 5 for R&D funding in Software subsectors: software publishing (3rd), data processing (4th), and computer systems design (4th), software R&D accounts for 15% of the state's overall company R&D
- Software-related verticals, SaaS and CloudTech & DevOps, rank 5th and 18nd, respectively, for venture capital investment in MA over the past 5 years with ~\$19.6B invested
- California leads states in SaaS and CloudTech & DevOps VC investment by a significant margin, but MA attracts the 3rd most Software-related VC investment capital nationally
- There have been over 147 successful exits by Software-related startups in the past 5 years, 145 mergers and acquisitions, and 2 IPOs

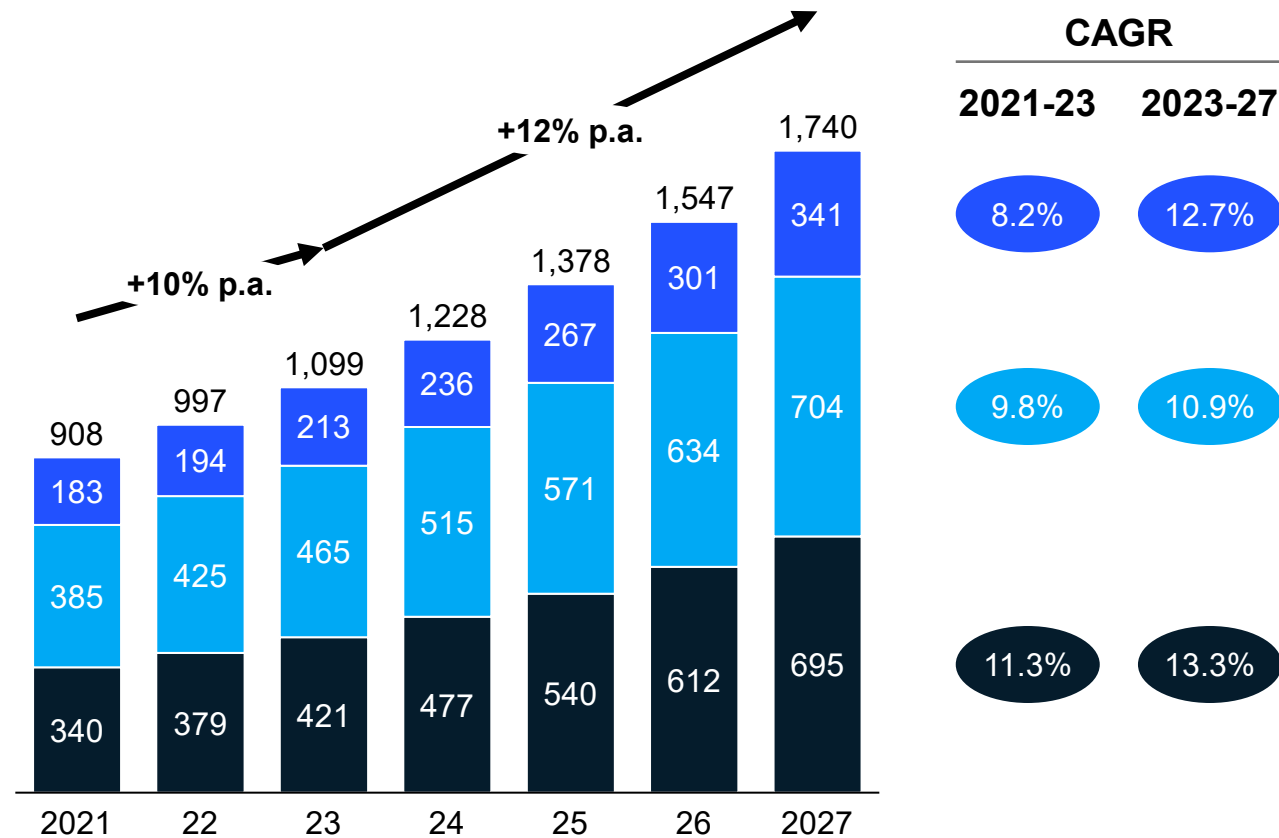
Objectives for today

- **Macro trends and dynamics**
 - Talent supply and demand
 - Investments in innovation

Current size of the global B2B software market is \$1,099 bn and it is expected to grow by 12% by 2027

Vertical Horizontal Infrastructure

Global B2B software market size by segment, 2021-2027, \$B






Growth drivers



- i Software is a critical source of differentiation and disruption across industries**
The number of top 100 product and service companies that are software-dependent has doubled, to nearly 40% over the last 20 years
- ii Software is constantly evolving**
The complexity of current software capabilities and the advances in underlying technology mean that software applications can quickly appear obsolete, driving continued innovation and growth
- iii Software adds material value for users across functions**
Software is crucial to growing and sustaining a business, serving to increase productivity, support revenue growth, and underpin ongoing operations
- iv Artificial intelligence is accelerating growth in software**
Software companies have started to add AI and ML features and capabilities to improve value proposition of specific software, accelerating growth

The industry can be segmented into vertical, horizontal and infrastructure software, each with high-growth sub-segments

Preliminary

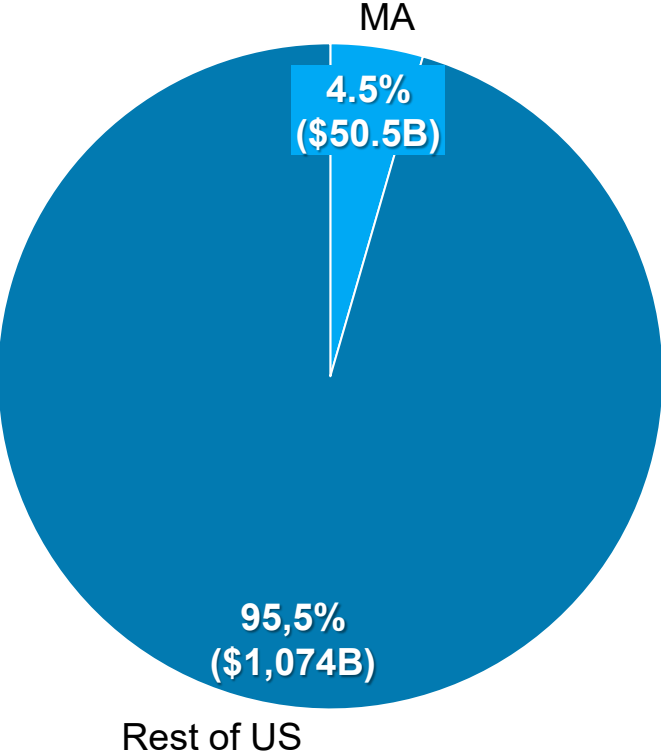
	Vertical SW 	Horizontal SW 	Infrastructure SW 
Description	Industry-specific SW for vertical applications (e.g., legal software for law organizations)	Broad-based SW used across verticals for certain functions (e.g., ERP, CRM)	SW used by IT specialists (e.g., for developers / IT operations professionals)
Dynamics	<ul style="list-style-type: none"> • Targeted customer base, fewer competitors • High-growth sub-segments 	<ul style="list-style-type: none"> • Extensive opportunities by leveraging existing customer base • Substantial M&A activity: strategic buyers growing their platforms 	<ul style="list-style-type: none"> • Data science / analytics driving next-gen products • Hybrid / multi-cloud adoption will also continue to drive growth
Attractiveness	<ul style="list-style-type: none"> • Automation driving growth; captive customers; limited competitors; high EBITDA margins • Need detailed understanding of verticals and use cases 	<ul style="list-style-type: none"> • Largest market size; broader base of cross-product synergies; fewer customizations • Likely requires interoperability with SAP, Oracle, major ERP SW 	<ul style="list-style-type: none"> • Greater ability to disrupt existing players via emphasis on technology • Requires deep understanding of new technologies to maintain market position
Risks	<ul style="list-style-type: none"> • Increasingly fragmented • Susceptibility to vertical-specific risks; individual subsegments smaller than horizontal / infrastructure 	<ul style="list-style-type: none"> • More winner-take-all; tends to be big organizations and conglomerates • 'Big tech' threat; most markets are duopolistic 	<ul style="list-style-type: none"> • Technological risk associated with new and competing tech

- Vertical or horizontal software players can make strong candidates for growth given their high switching costs and captive customer bases
- Adjacent sub-sector knowledge, e.g., of interoperable programs and emerging technologies, is likely critical to establishing a scalable talent pipeline

Massachusetts houses one of the largest Software sectors in the country, but other states are competing for growth

Market Size

National Software GDP reached \$1,124.6B in 2022, with Massachusetts providing a 4.5% share



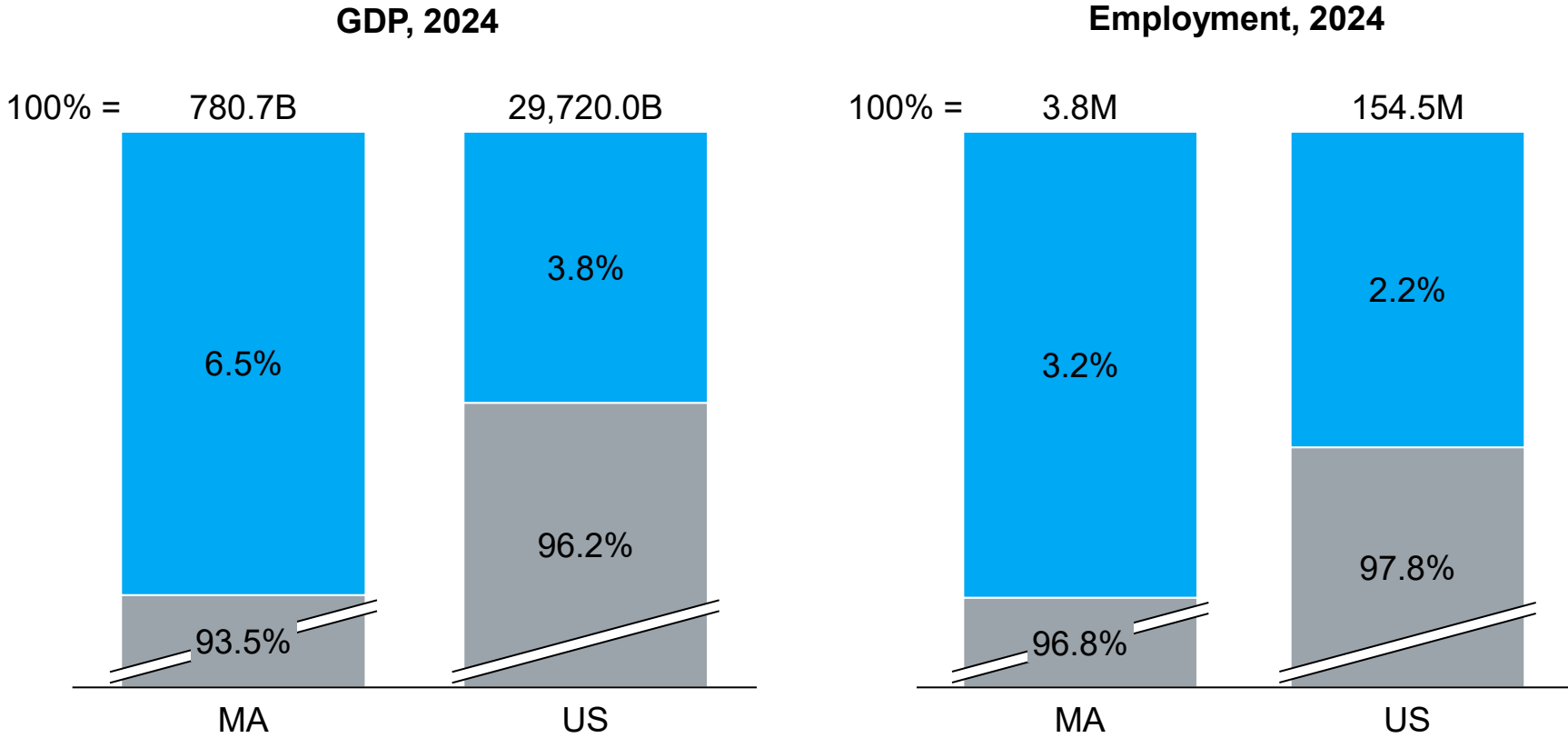
Rank	State	2024 Software workforce, Ths.	Share of workforce, 2024, %	Projected job growth, 2024-2029 CAGR
1	California	497	2.7%	1.9%
2	Texas	358	2.6%	3.3%
3	Virginia	183	4.5%	1.0%
4	New York	181	1.9%	2.5%
5	Florida	178	1.8%	2.5%
6	Washington	172	4.8%	2.7%
7	Massachusetts	121	3.3%	0.8%
8	Georgia	120	2.5%	2.3%
9	Colorado	116	4.0%	3.0%
10	North Carolina	114	2.3%	2.6%

The Software sector accounts ~7% of the state's GDP and ~4% of employment, a larger share of both GDP and employment than the US overall

Preliminary

Software GDP and employment as share of total economy
2024, %

■ Computing ■ Rest of economy



- The share of the MA economy's GDP driven by Software is 1.7x greater than the US average
- The share of the MA economy's employment driven by Software is 1.5x greater than the US average

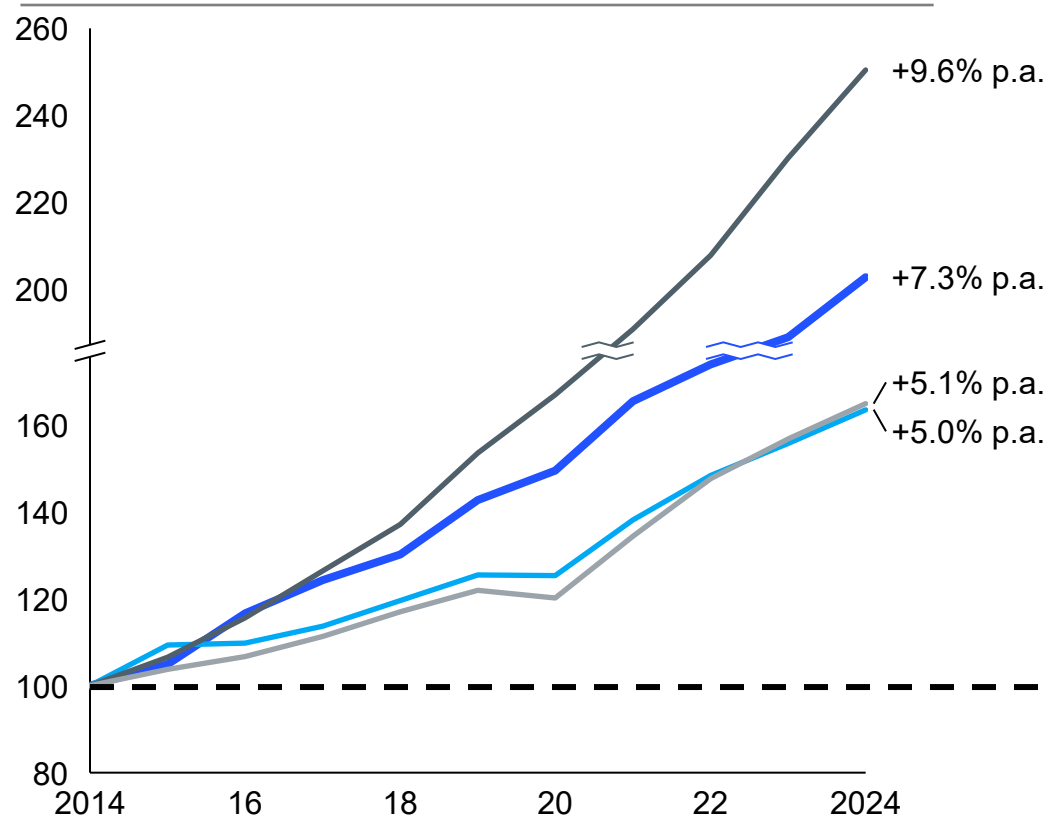
Historically, MA's Software sector GDP and employment growth has outpaced the state average, the US Software sector growth outpaced MA's within the past 10 years

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MA software MA total US software US total

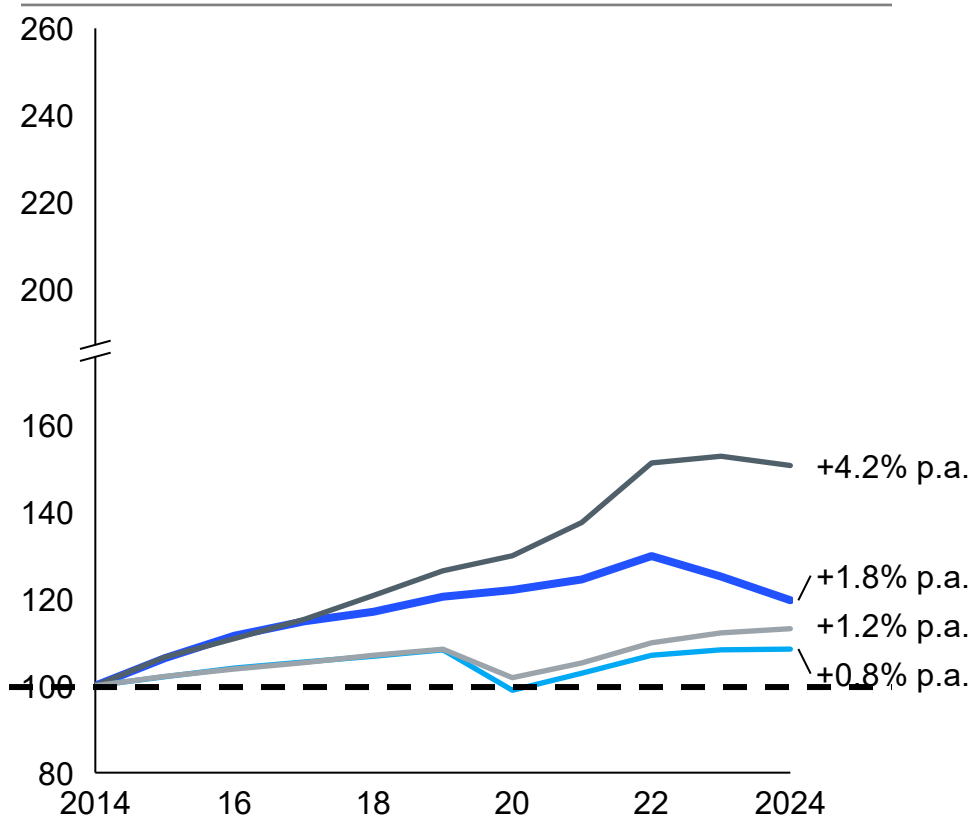
Software Innovation GDP Growth

Indexed to 2008



Software Innovation Employment Growth

Indexed to 2008

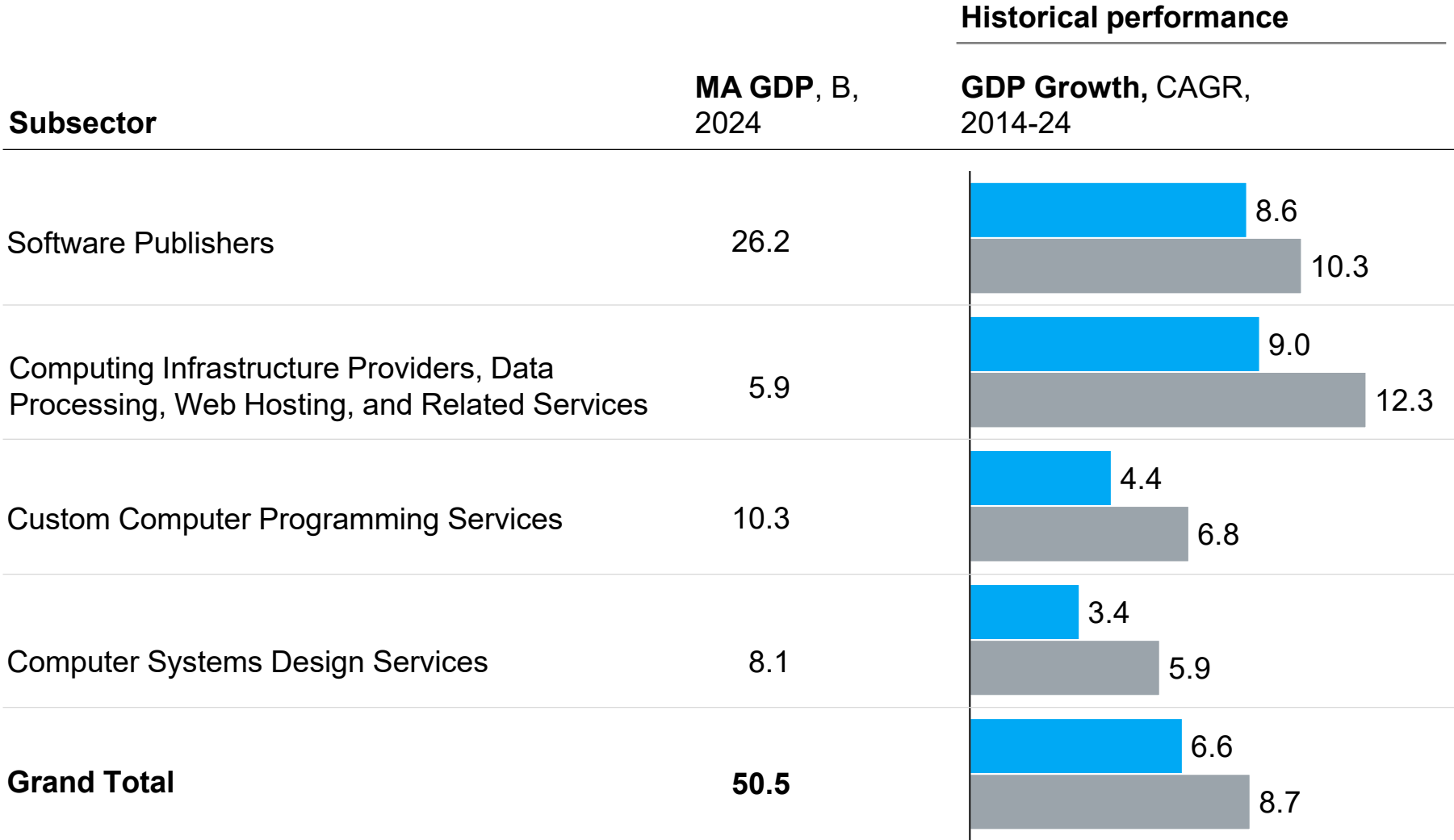


- MA's Software sector grew on par with the US overall in the first part of the decade, but the national Software sector GDP pulled ahead in 2017 and has grown at a faster pace since
- Similarly, MA's Software sector employment grew on par with the US Software sector only until around 2017

MA GDP growth lagged that of the US across all Software subsectors

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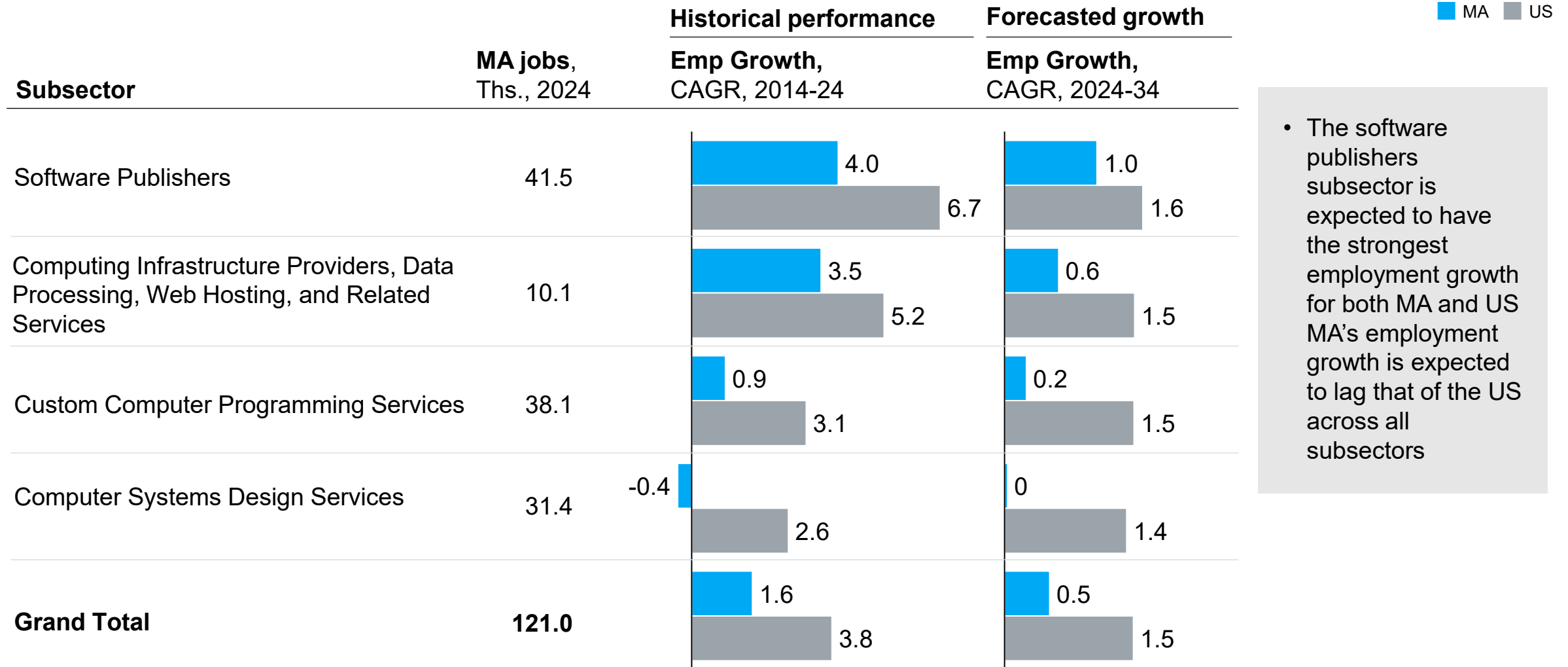
MA US



- Computer infrastructure providers experienced the strongest growth over the past decade in both in MA and the US.
- Though all subsectors grew by at least 3%, none out-paced the US in GDP growth

Looking forward, Software employment in the MA and US overall is expected to slow compared to historical growth across all subsectors

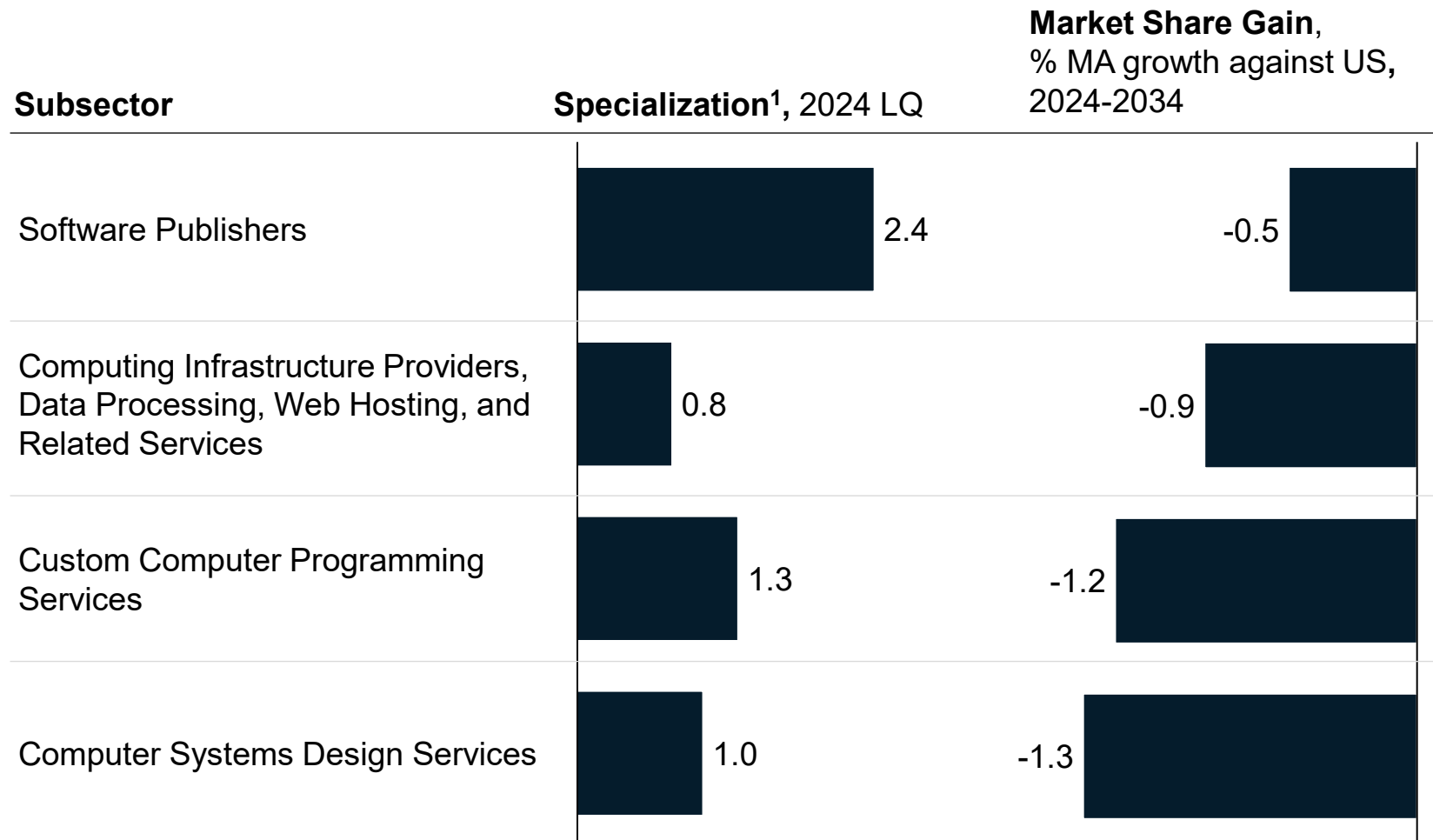
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- The software publishers subsector is expected to have the strongest employment growth for both MA and US
- MA's employment growth is expected to lag that of the US across all subsectors

MA is expected to lose market share in all Software subsectors

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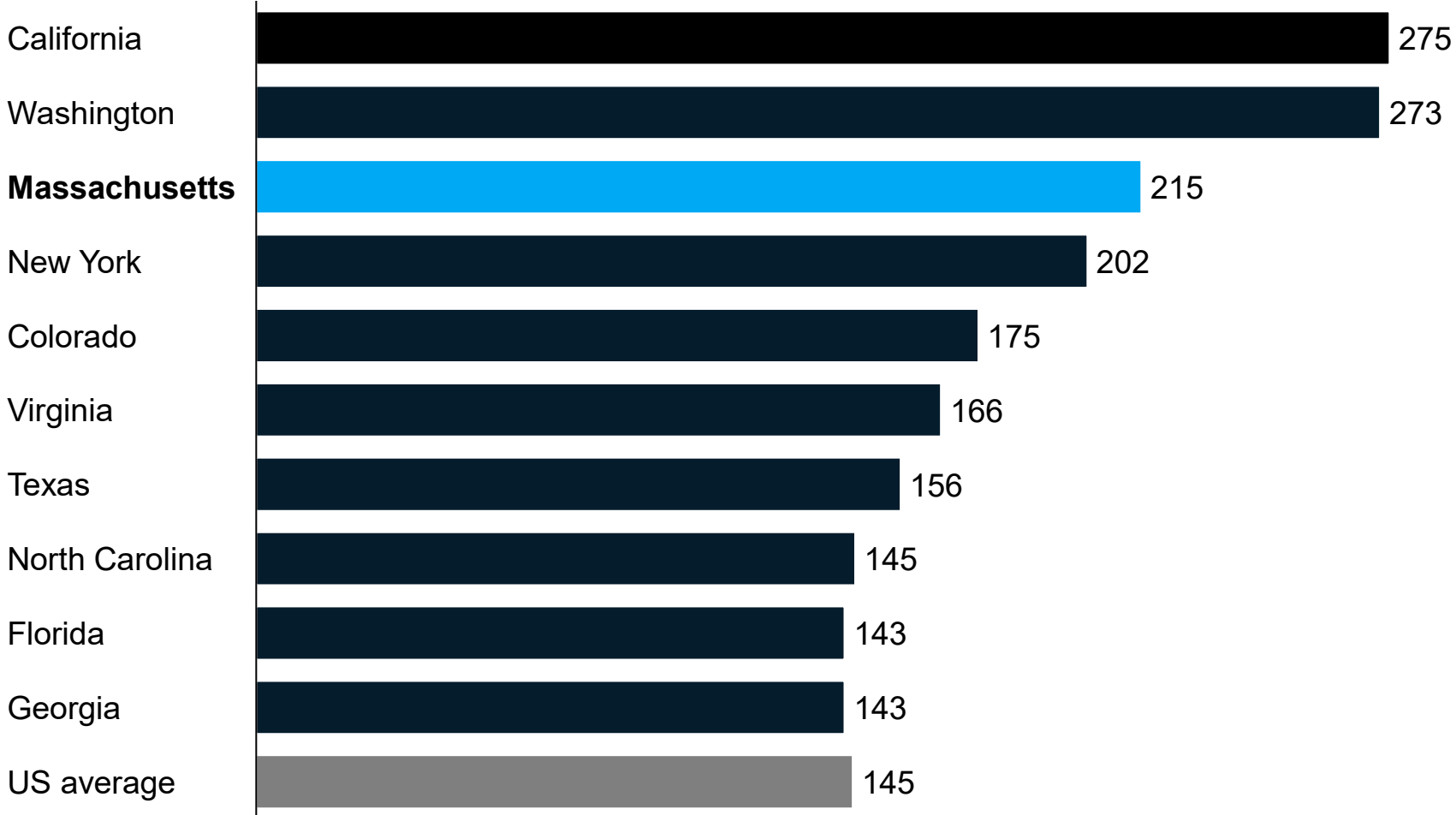


- Over the next 10 years, MA is expected to lose the most market share in the computer system design services, closely followed by computer system design services
- Software publishers is MA's most specialized sub-sector, though growth is still expected to lag the US by 0.5%

1. Specialization (LQ) is measured as the ratio of a sector's share of employment in a region to that sector's share of employment in the US

Among top 10 states for Software employment, MA has the highest 3rd highest wages, behind Washington and California

Software wages by state, \$, Ths., 2024



- MA has higher wages in its software sector compared to most other states with a large software sector, and the US average
- Subsectors that pay the highest in MA are Custom Computer Programming Services and Software Publishers

Objectives for today

- Macro trends and dynamics
- **Talent supply and demand**
- Investments in innovation

MA is producing enough graduates to fill open roles in many high-demand tech occupations

Preliminary

Top occupations within Software sector¹ in MA

■ <50% Completions relative to Openings
 ■ 51-75% Completions relative to Openings
 ■ >75% Completions relative to Openings

Occupations	Job openings, 2024, K	Completions ¹ , 2024	Typical entry level education
General and Operations Managers	9.3	9545	Bachelor's degree
Customer Service Representatives	7.3		High school diploma or equivalent
Accountants and Auditors	4.0	2063	Bachelor's degree
Software Developers	3.8	4663	Bachelor's degree
Market Research Analysts and Marketing Specialists	3.5	4162	Bachelor's degree
Sales Representatives of Services	3.3		High school diploma or equivalent
Management Analysts	2.9	1565	Bachelor's degree
Human Resources Specialists	2.4	1187	Bachelor's degree
Computer and Information Systems Managers	2.1	2598	Bachelor's degree
Project Management Specialists	1.7	2020	Bachelor's degree
Computer User Support Specialists	1.4		Some college, no degree
Marketing Managers	1.2	1035	Bachelor's degree
Computer Systems Analysts	1.1	1076	Bachelor's degree
Sales Representatives	1.0	310	Bachelor's degree
Data Scientists	0.9	728	Bachelor's degree
Software Quality Assurance Analysts and Testers	0.5	546	Bachelor's degree

- Though MA seems to have a good supply of tech graduates for some roles, local employers must compete on a national scale
- All but 3 of the top in-demand occupations in the software sector require a bachelor's degree or higher

1. Based on 2024 employment in industry
 2. To adjust for duplication, the number of completions within each degree program (CIP) was distributed to each corresponding occupation (SOC) typically requiring a four-year degree or higher by way of a weighted average based on current employment within occupations

MA ranks 12th nationally for number of computer and mathematical jobs, and has the 3rd highest median wages

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Top 15 states for computer and mathematical occupations

States	Jobs, Ths. 2024	Median wages, Ths., 2024	LQ, 2024
California	731.2	\$138.3	1.2
Texas	495.0	\$105.2	1.1
New York	298.6	\$118.1	0.9
Florida	287.2	\$98.7	0.9
Virginia	235.5	\$122.0	1.7
Washington	210.3	\$140.4	1.8
North Carolina	184.8	\$108.0	1.1
Illinois	177.1	\$100.7	0.9
Pennsylvania	172.8	\$95.2	0.9
Georgia	165.0	\$102.2	1.0
New Jersey	162.5	\$114.9	1.1
Massachusetts	155.1	\$123.2	1.3
Ohio	146.2	\$93.4	0.8
Maryland	137.2	\$122.2	1.5
Colorado	137.0	\$116.0	1.4

- Among the top 15 states by number of jobs, Washington, Virginia, Maryland, and Colorado have the highest degree of specialization in computer and math occupations, followed by Massachusetts
- Washington has the highest median wages for computer and math occupations, followed by California and Massachusetts

MA universities produced ~24K Software-related graduates in 2023, accounting for 16.6% of total completions in the state

Completions in Software and related programs^{1,2}, 2023

Top 15 MA universities, by number of completions

		% of total completions	Growth, 2018-2023 CAGR
Northeastern University	4,843	49.3%	11.3%
Massachusetts Institute of Technology	2,361	57.1%	1.3%
Boston University	2,344	17.4%	5.0%
University of Massachusetts-Amherst	2,003	18.7%	8.1%
Worcester Polytechnic Institute	1,719	79.4%	1.9%
University of Massachusetts-Lowell	1,548	31.4%	-0.1%
Harvard University	1,138	10.3%	3.4%
Tufts University	956	19.6%	6.1%
Berklee College of Music	927	43.1%	91.2%
Wentworth Institute of Technology	535	55.6%	0.3%
Northeastern University Professional Programs	529	15.4%	8.4%
Brandeis University	418	18.2%	0.0%
Boston College	389	7.6%	0.5%
University of Massachusetts-Boston	378	10.5%	5.2%
Clark University	278	20.0%	13.1%
Total	23,866	16.6%	4.2%

Preliminary

- Software-related completions account for 16.6% of total completions in the state, and account for over half of completions in some schools (MIT, WPI, Wentworth)
- Completions in Software-related programs has grown in all but 2 of the top 15 universities

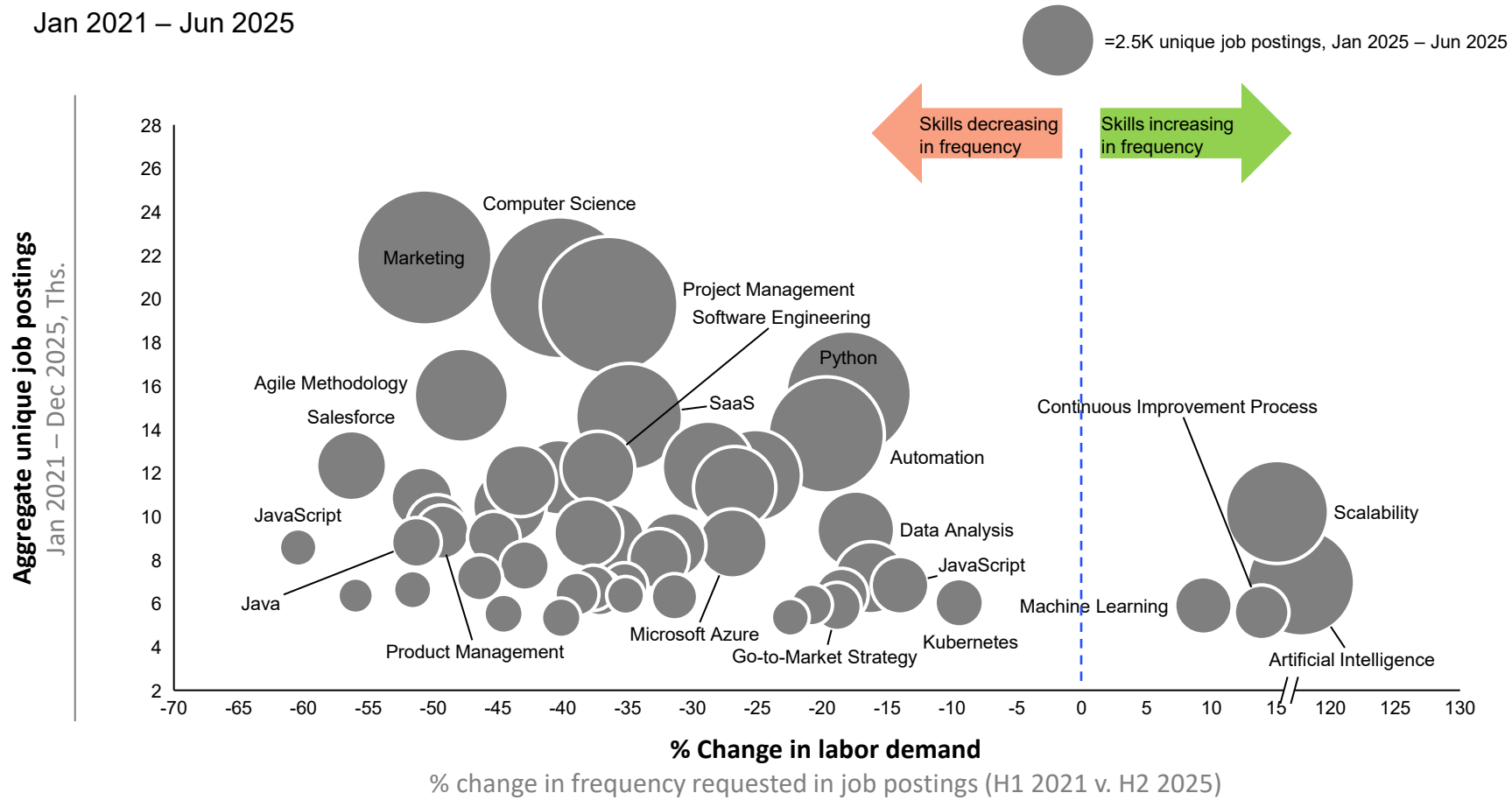
1. CIP codes: Computer and Information Sciences and Support Services (11), Engineering (14), Engineering/Engineering-related Technologies/Technicians (15), and Mathematics and Statistics (27); 2. All program types; 3. Overall university retention rate, not program specific

AI and related skills are increasing in frequency in software job postings

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Top 50 in-demand hard-skills¹ for MA employers in the Software sector

Jan 2021 – Jun 2025



- Demand for skills including artificial intelligence, scalability, and machine learning has increased the most
- Job postings for most Software sector skills have declined in frequency since H1 2021
- General skills like marketing, project management, and computer science have been in highest demand from 2021-25
- Demand for some programming languages (Java, JavaScript) is declining the most

1. Based on job postings filtered by Software NAICS in MA. Specialized, software, and certificate skills only (excludes common skills).

In the first half of 2025, Oracle, Accenture, and Arinc International have been seeking the most workers to fill Software-related roles

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MA companies	Job postings, Unique postings, Jan-Jun 2025	% of postings	MHTC membership
Oracle	1,611	10%	no
Accenture	1,030	7%	no
Arinc International Of Canada Ulc	365	2%	no
MITRE Corporation	313	2%	yes
Klaviyo	306	2%	no
Anduril Industries	273	2%	no
Confluent	240	1%	no
MathWorks	231	1%	no
Red Hat	214	1%	yes
Workday	213	1%	no
Datavant	203	1%	no
ZoomInfo Technologies	189	1%	no
Pegasystems	175	1%	yes
CACI International	162	1%	no
Autodesk	157	1%	no

- ~1000 companies in the in MA are seeking Software-related talent
- The top 15 companies seeking Software-related talent, 3 are MHTC members

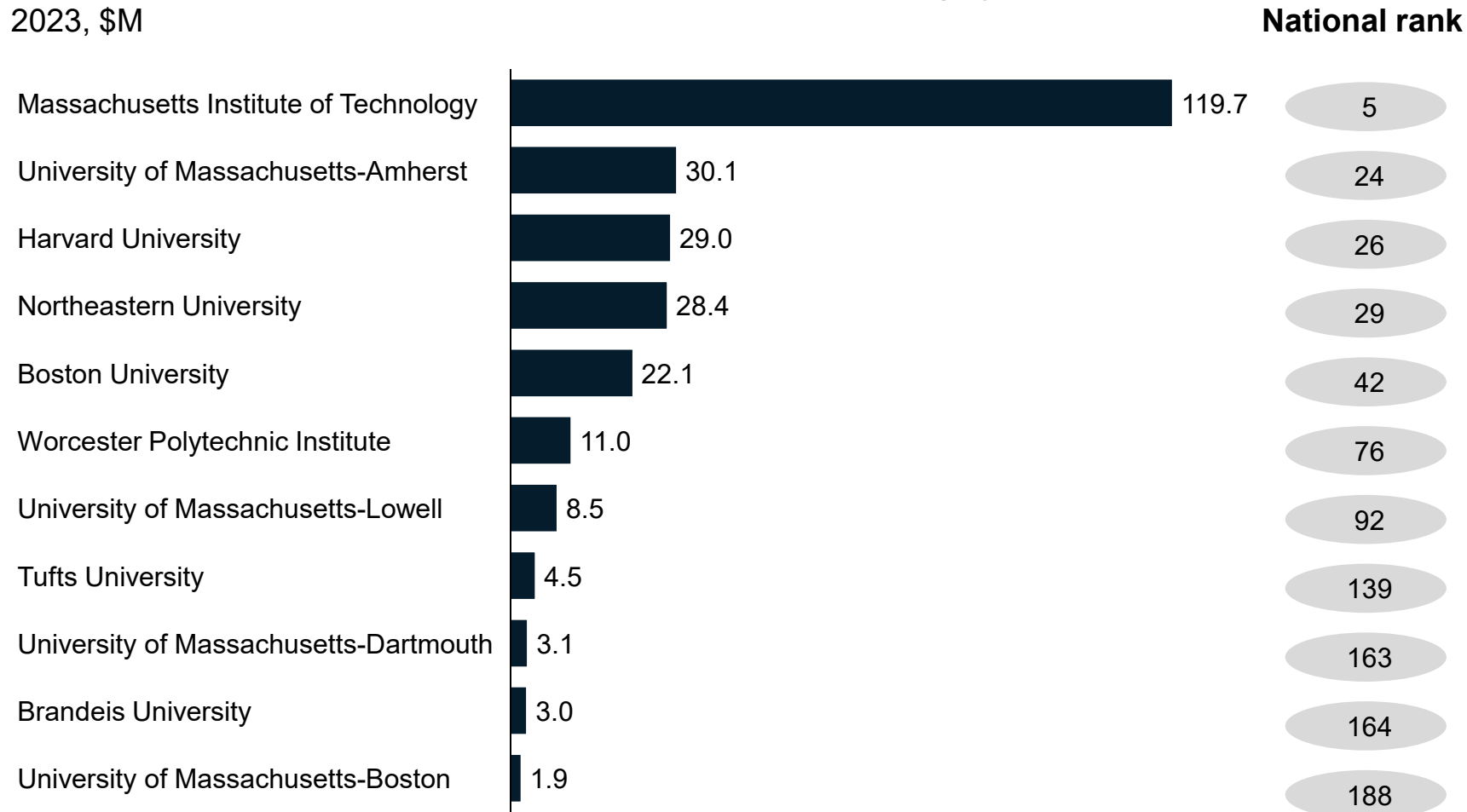
Objectives for today

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- Talent supply and demand
- **Investments in innovation**

MIT leads the state's R&D in computer and information sciences by a wide margin, followed by UMass Amherst

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MA computer and information sciences academic R&D funding by institution ¹, 2023, \$M

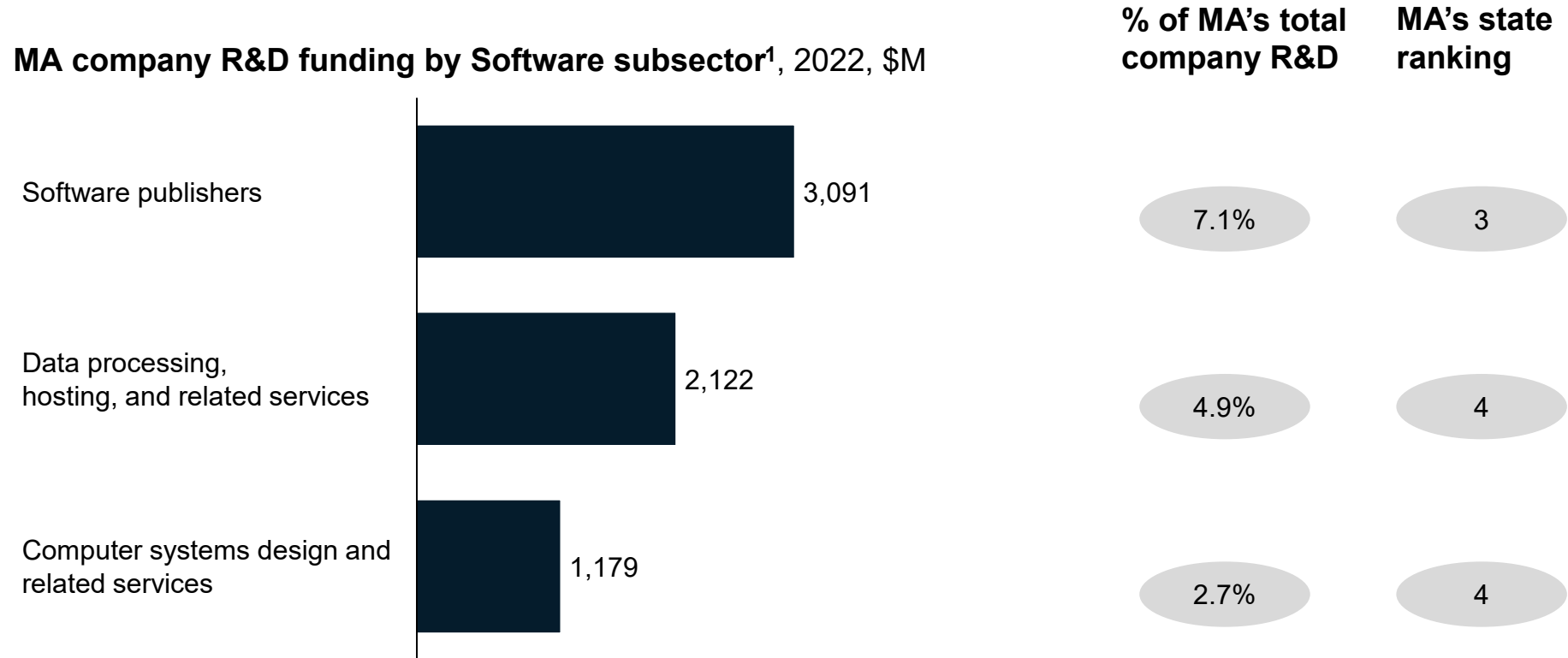


- MIT is the only MA university in the top 10 nationally for Software-related R&D
- 22 MA universities are currently funding software-related R&D, 7 of those rank within the top 100 nationally for R&D funding in the field
- Johns Hopkins, Carnegie Mellon, and Georgia Institute of Technology are the top 3 nationally in computer and information sciences R&D

1. Includes institutions ranked within the top 200 nationally

MA Software companies invested \$6.4B in R&D in 2022, 15% of the state's overall company R&D

Preliminary



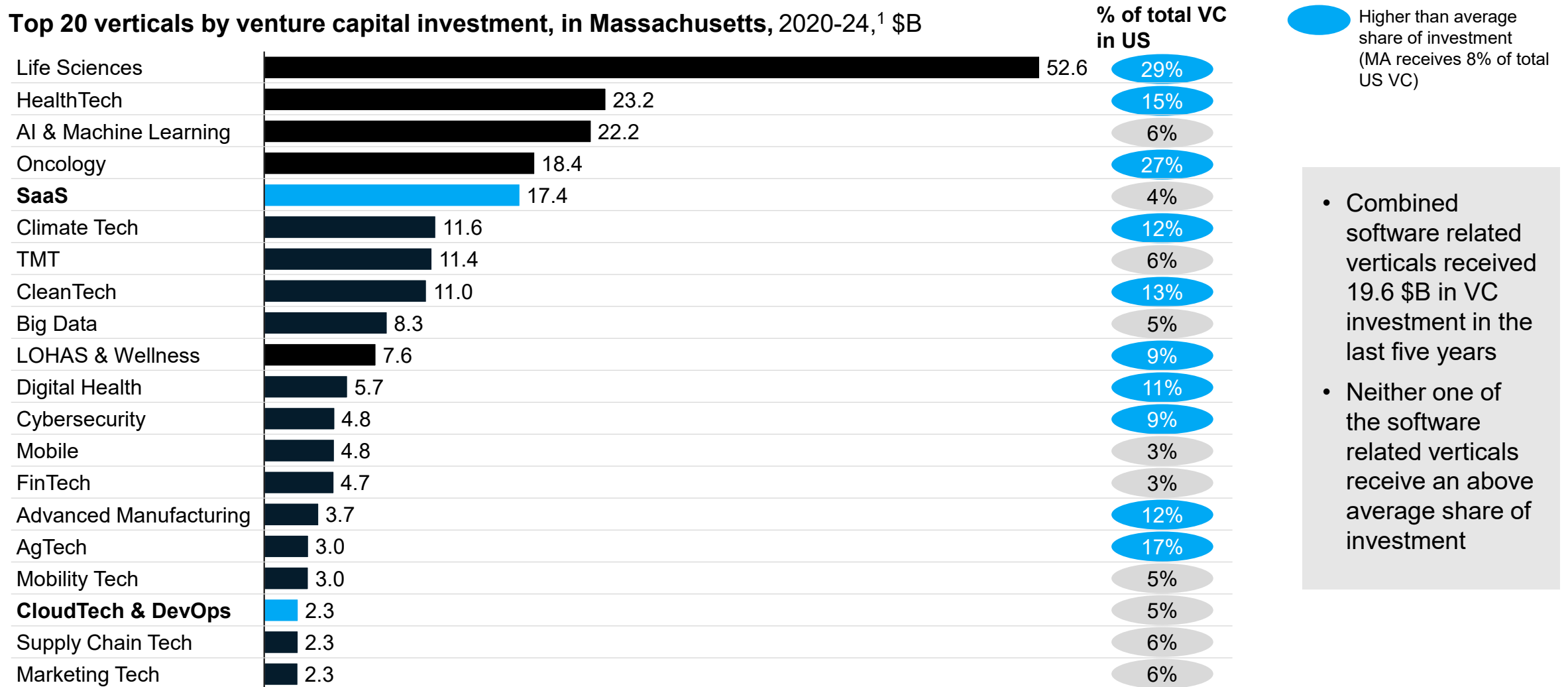
- Software company R&D increased by 44% in MA since 2021 (growth in company R&D funding overall was 15%)
- Washington and California lead in R&D by companies in the software publisher industry, funding in WA (\$18.9B) is over 6x that of MA
- CA (\$25.9B) leads in R&D by data processing companies, over 10x the funding than the next state, NY (\$2.6B)

1. Domestic R&D paid for and performed by the company, based on 6 and 4-digit NAICS codes

Software-related verticals, SaaS and CloudTech & Dev Ops, rank 5th and 18th in MA for venture capital investment over the past 5 years

Preliminary

Top 20 verticals by venture capital investment, in Massachusetts, 2020-24,¹ \$B



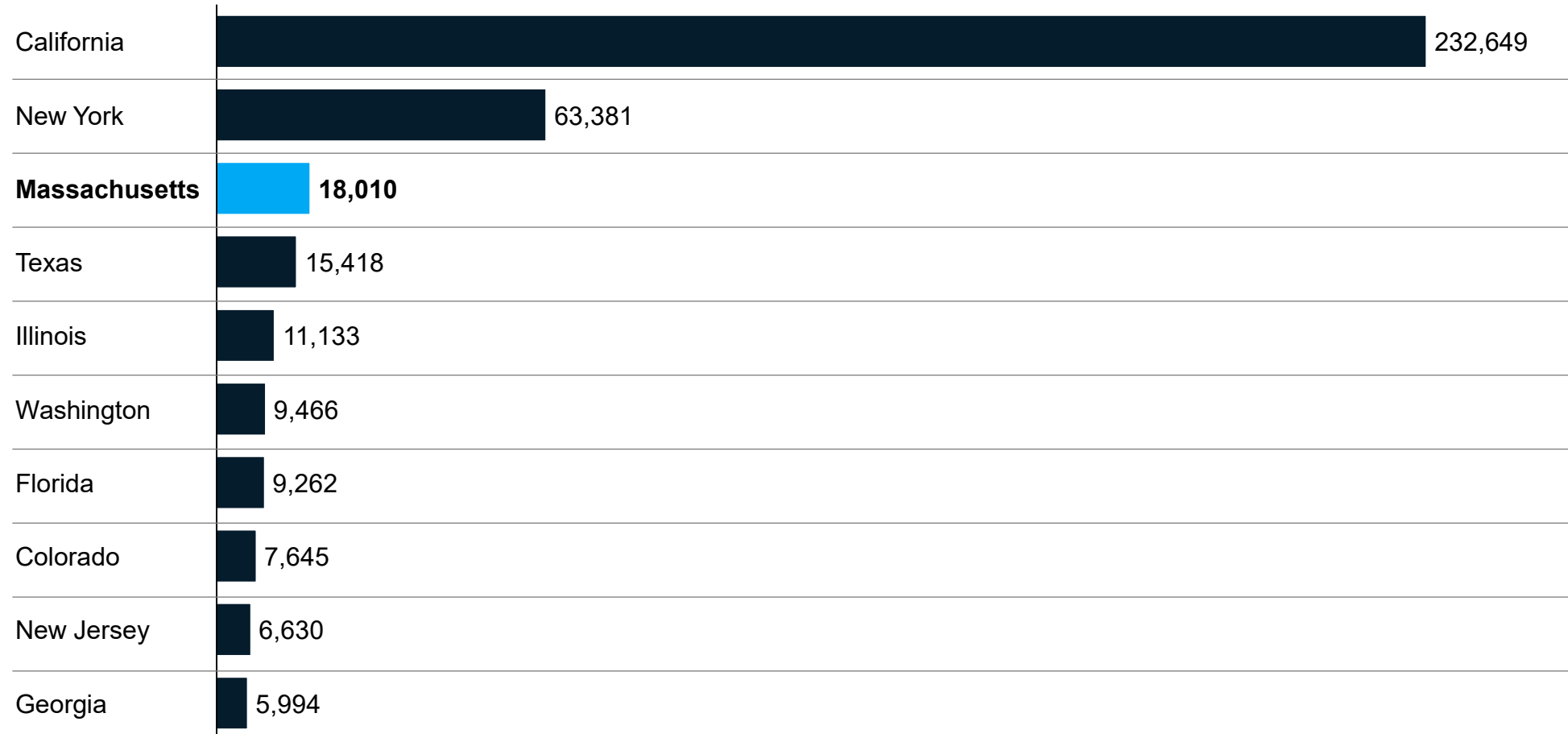
- Combined software related verticals received 19.6 \$B in VC investment in the last five years
- Neither one of the software related verticals receive an above average share of investment

1. Figures will not sum up to total as multiple tech verticals can be applied to one deal; removed high-level verticals that include other verticals such as "Manufacturing" and "Industrials"

Massachusetts ranks 3rd nationally in Software venture capital investment

Preliminary

Top 10 states for Software related verticals¹ VC investment, 2020-24, \$, Million



- California leads in Software VC investment nationally, attracting over half of total software VC in the US
- Massachusetts ranks 3rd in software VC investment, attracting less than a third of the 2nd ranking state, New York

¹ Includes verticals SaaS and Cloud & DevOps

There have been 6 Software startup valued over \$1B in MA over the last 5 years

~34

Software early-stage startups active¹ in MA (there are an additional 300+ generating revenue or profitable)

2

IPO in the past 5 years

145

M&A exits in the past 5 years

1. Active startups defined as: Privately held, PE, VC, or accelerator/incubator, or angel backed with business status stealth, product development or startup

Preliminary

Top 10 transactions by deal size, Software startups,

2020-2024

Company	Exit type	Exit date	Approx. valuation, \$M
Toast (NYS: TOST)	IPO	2021	20,104
Nuance Communications	M&A	2022	18,767
Klaviyo (NYS: KVYO)	IPO	2023	7,556
Turbonomic	M&A	2021	1,834
ETQ	M&A	2022	1,200
AltioStar	M&A	2021	1,000
Arena Solutions	M&A	2021	715
Sontiq	M&A	2021	643
Reflexis Systems	M&A	2020	548
Capsule Technologies (US)	M&A	2021	539