



TECHNOLOGY JOBS IN MASSACHUSETTS

THE DEMAND FOR A MASSACHUSETTS TECHNOLOGY
WORKFORCE

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Executive Summary

Massachusetts is a hotbed of demand for technology jobs. This report takes a closer look at this demand in the commonwealth, focusing on educational and skills requirements as well as common industry-recognized credentials for computer science, information technology (IT), and IT-adjacent jobs.

Almost one in four jobs (23 percent) in Massachusetts involve computer science skills — significantly higher than the national average of less than 18 percent. These jobs include programmers developing new software, IT staff managing technology systems, and analysts using quantitative software tools to make data-based decisions. Among these jobs, employers are having a hard time finding qualified candidates; nine of the top 10 technology occupations (shown in Table 2) take longer than average to fill in the commonwealth.

Unsurprisingly, the demand for technology jobs is heavily concentrated in the eastern part of Massachusetts. As shown in Appendix B, more than two-thirds of all demand in Suffolk and Middlesex Counties, which contain Boston and Cambridge. These counties include eight of the 10 largest universities in the state.

Massachusetts employers are significantly more likely to request a bachelor's degree for technology occupations than the rest of the country. Only 7.6 percent of technology job postings in Massachusetts ask for less than a bachelor's degree, compared to 13.4 percent nationally. For example, as shown in Table 3 below, Computer Support Specialist postings are almost 50 percent more likely to request a bachelor's degree in Massachusetts than nationally.

The trends illustrated in this report show the importance of increasing the supply of people with computer science knowledge and skills in Massachusetts, and in the Boston area in particular. The report ends with suggested next steps for the Massachusetts education community for fostering growth of student interest in computer science in K–12 and a clear pathway for a successful postsecondary experience in a technology field.

Achieve would like to thank the GE Foundation, whose generous support made this report possible. Support from the GE Foundation has also allowed Achieve to successfully promote college and career readiness (CCR) as a national priority, focusing attention on improving outcomes for all K–12 students, particularly in the areas of STEM and computer science education, and mobilize business community stakeholders committed to advancing and sustaining the CCR agenda.

Introduction

The spread of technology is changing the overall composition of the workforce and the skills required of workers across a range of occupations. Technology jobs are critical for employers beyond the Information industry; in fact, the industry sectors with the largest overall demand for technology workers in Massachusetts are Professional Services and Finance.

Three years ago, the Massachusetts Department of Higher Education identified the technology workforce as the ‘focus of statewide prioritization’ for aligning supply of candidates with statewide demand.¹ Business leaders in Massachusetts report a shortage in the supply of qualified candidates for technology jobs in the commonwealth. Rapid growth of technology jobs threatens to further exacerbate the challenge, leading the state to launch this initiative.

Achieve, the nation’s leading expert resource on college and career readiness, commissioned the premier job analytics firm, Burning Glass Technologies, to better understand the specific nature of technology workforce demand in Massachusetts. The following report focuses on the demand for technology workers at both the baccalaureate and sub-baccalaureate levels and describes the occupation and credential needs, including both specific skills and certifications, of employers. The intent of this research is to inform policymakers and educators in developing action steps to address the Department of Higher Education’s Workforce Plan, to think about what pathways to a technology career look like, and to determine whether and how to incorporate high school computer science courses into MassCore, the state’s college- and career-ready program of study. This paper places particular emphasis on understanding the technology jobs in high demand across Massachusetts, and the skill and certification demands associated with them to provide direct guidance regarding employer demand in technology.

Defining Technology Jobs

In this analysis, we define technology jobs as those working directly in information technology, which includes roles that require coding skills in which instructions are written to a computer.² These include computer programming languages, like Java and Python, statistical packages such as R, and website development skills such as HTML5.

The technology jobs are broken into three categories:

- **Computer Science and Management:** Roles such as software developers and IT managers that are focused on development and programming on a daily basis;
- **Information Technology:** Roles supporting and building technology systems within offices, such as Computer Support Specialists; and
- **IT-adjacent:** Roles that use coding skills as a part of the job, but not as the key competency, such as Management Analysts and Graphic Designers.

¹ *Technology Talent Initiative: Workforce Plan*. Massachusetts Department of Higher Education. May 5, 2014.

² *Beyond Point and Click: The Expanding Demand for Coding Skills*. Burning Glass Technologies. June 2016.

Demand for Technology Jobs in Massachusetts

Technology occupations are in high demand in Massachusetts, representing nearly 23 percent of total job demand (compared to less than 18 percent of total job demand nationally). Traditional technology³ jobs in the **Computer Science** and **Information Technology** categories, where IT skills are a prerequisite of the job, represent over 13 percent of the local market, with over 90,000 job postings in the past 12 months, as shown in Table 1.

Additionally, 64,000 jobs (9 percent of the market) fall into **IT-adjacent categories**. In these occupations, technology skills are often requested by employers, but are not a universal prerequisite. These skills make a candidate more qualified to succeed in the role. There is a higher concentration of IT and adjacent occupations in Massachusetts than nationally, reflecting the high-tech nature of industries in the commonwealth.

Table 1: Occupational Demand, Massachusetts

Area	Massachusetts Postings	Average Salary, Massachusetts	Percent of Massachusetts Market	Percent of National Market
Information Technology	46,305	\$79,525	6.8%	5.7%
Computer Science and Management	44,157	\$96,546	6.5%	4.6%
IT-adjacent	64,104	\$71,021	9.4%	7.3%
Non-Technology	525,806	\$51,633	77.3%	82.4%
Grand Total	680,372	\$58,273	--	--

Massachusetts employers are having a difficult time filling many of their technology roles. Nine of the top 10 technology occupations, shown in Table 2, take longer than average to fill in the commonwealth. This highlights a local struggle to fill high-demand, high-paying jobs.

Table 2: Top Technology Occupations, Massachusetts

Occupation	Cluster*	Postings	Average Salary	Time to Fill Postings	Projected Growth
Software Developer / Engineer	CS	29,492	\$96,759	Very Long	4%
Business / Management Analyst	Adjacent	7,432	\$80,996	Long	7%
Computer Support Specialist	IT	6,136	\$49,152	Short	4%
Systems Analyst	IT	5,835	\$82,844	Very Long	5%
Marketing Manager	Adjacent	5,691	\$80,217	Long	4%
Web Developer	IT	5,235	\$82,347	Long	5%
Network Engineer / Architect	IT	4,962	\$90,001	Long	6%
Computer Systems Engineer / Architect	IT	4,757	\$100,146	Very Long	3%
IT Project Manager	CS	4,733	\$101,642	Very Long	3%
Financial Analyst	Adjacent	4,477	\$71,823	Long	5%

*Cluster Definitions: CS=Computer Science and Management; IT=Information Technology

Source: Burning Glass Technologies and Bureau of Labor Statistics (projections)

³ Technology jobs are organized to reflect the definitions in *Technology Talent Initiative: Workforce Plan*, with jobs split into IT and Computer Science as separate occupation groups.

Top Sub-Baccalaureate Opportunities

In 2016, employers posted more than 29,000 jobs in occupations which typically are open to sub-baccalaureate candidates, such as Computer Support Specialists, Network Administrators, and Computer Programmers. However, local employers commonly request higher credentials for these roles than their national counterparts. For example, Computer Support Specialist postings are nearly 50 percent more likely to request a bachelor's degree in Massachusetts than nationally.

The demand for higher credentials creates challenges for high school and associate's degree graduates seeking employment, where higher degrees are used in place of skill qualifications. This represents an opportunity for regional initiatives to close gaps in the IT workforce; if employers broaden their credential requirements, they will open up additional pools of qualified applicants. Table 3 displays large occupations that more often recruit sub-baccalaureate candidates nationally than within Massachusetts.

Table 3: Top Sub-Baccalaureate Technology Occupations, Massachusetts

Occupation	Cluster	Massachusetts Postings, 2016	% Requesting B.A., Massachusetts	% Requesting B.A., National
Computer Support Specialist	IT	6,136	66%	45%
Network Engineer / Architect	IT	4,962	85%	77%
Network / Systems Administrator	IT	3,688	86%	79%
Database Administrator	IT	3,456	82%	77%
Computer Programmer	CS	1,951	87%	79%
Graphic Designer / Desktop Publisher	Adjacent	1,232	94%	79%
General / Electrical Engineering Technician	Adjacent	865	26%	18%
Manufacturing / Production Technician	Adjacent	746	19%	16%
Supply Chain / Logistics Manager	Adjacent	684	87%	80%
Logistician / Supply Chain Specialist	Adjacent	605	83%	70%

Importantly, these are high paying jobs; the 25th percentile salary for these roles, a proxy for entry-level salary, ranges from \$28,000-\$75,000, with the average considerably higher. Employers seeking to close the workforce gap could increase the recruitment of sub-baccalaureate candidates into the positions, rather than relying on bachelor's degree holders as is done at present.

Table 4: Sub-Baccalaureate Salaries, Massachusetts

Occupation	Entry Level Salary*	Average Salary
Computer Support Specialist	\$38,091	\$49,152
Network Engineer / Architect	\$75,000	\$90,001
Network / Systems Administrator	\$55,000	\$70,000
Database Administrator	\$66,560	\$83,200
Computer Programmer	\$67,234	\$87,698
Graphic Designer / Desktop Publisher	\$36,597	\$47,925
General / Electrical Engineering Technician	\$34,581	\$44,781
Manufacturing / Production Technician	\$28,861	\$37,664
Supply Chain / Logistics Manager	\$45,000	\$65,000
Logistician / Supply Chain Specialist	\$44,319	\$56,337

*25th percentile of salaries for the occupation.

Skill Demand

Skill demands between sub-baccalaureate and bachelor’s level jobs are similar, but have distinct differences that provide insight for employees and the workforce system. Regardless of education level, SQL, Linux, and Java are in high demand and critical to success in technology jobs. Within sub-baccalaureate roles, there is higher demand for the technical support work that aligns with the roles such as Computer Support Specialist and Network Administrator. Demand for Microsoft Operating Systems, VoIP systems, and networking are significantly higher for the sub-baccalaureate positions, a trend that may provide guidance on programs of study required and specific skills sets for the workforce system to focus on.

Alternatively, the bachelor’s degree demand leans more heavily toward programming skills, such as C# and Python, and advanced SQL Server skills required for database management.

Table 5: Total Technology Skill Demand, Massachusetts

Top Skills. Sub-B.A. Computer Jobs Massachusetts	Top Skills. B.A. Computer Jobs Massachusetts
SQL	SQL
LINUX	JAVA
JAVA	LINUX
Oracle	Oracle
UNIX	JavaScript
Virtual Private Networking (VPN)	Microsoft C#
Microsoft Operating Systems	UNIX
VMware	Python
JavaScript	C++
Voice over IP (VoIP)	SQL Server

Certification Demand Signals Advancement Opportunity

Certifications can serve as proxies for higher degrees, allowing job seekers to demonstrate the proficiencies required for a specific job in a form that is well recognized by employers. They also signal a clear career pathway for employees, identifying specific skills needed to move forward in a career.

The following tables show demand for the top certifications within each of the technology occupation clusters—Computer Science and Management and Information Technology—while also highlighting the differences in demand by requested levels of education. The certifications required vary based on the education level requested by employers.

Within Information Technology roles, there is broad demand for the certifications that outline a path for upward advancement within the field. Cisco defines its certifications along a four-step career pathway, Entry-Level, Associate, Professional, and Expert.⁴ The in-demand networking certifications are typically at the Associate level and higher. The highest demand – Certified Internetwork Expert and Certified Network Professional – come from Cisco’s ‘Expert’ and ‘Professional’ levels. These certifications provide specific

⁴ *Career Certifications and Paths*. Cisco. See http://www.cisco.com/c/en_in/training-events/career-certifications.html

guidance on key credentials needed to enter and thrive in the Massachusetts technology market. Candidates with Expert-level certifications can stand out from the market without obtaining a bachelor’s degree.

Bachelor’s degree jobs in IT often call for cybersecurity skills. Of the 10 certifications with significant demand, five are related specifically to cybersecurity. This represents a critical area of focus in the commonwealth, as well as nationally, where certifications are the key indicator of cybersecurity expertise.

Table 6: Massachusetts Certification Demand, Information Technology Roles

Top sub-B.A. Certifications, IT	Top Bachelor’s Level Certifications, IT
Cisco Certified Internetwork Expert (CCIE)	Security Clearance
Cisco Certified Network Professional (CCNP)	Certified Information Systems Security Professional (CISSP)
Cisco Certified Network Associate	Certified Information Systems Auditor (CISA)
Certified A+ Technician	Cisco Certified Network Associate
Certified Information Systems Security Professional (CISSP)	Certified Information Security Manager (CISM)
Security Clearance	SANS/GIAC Certification
	Project Management Certification (e.g., PMP)
	Cisco Certified Network Professional (CCNP)
	Security+
	The Open Group Architecture Framework (TOGAF)

In Computer Science, two of the in-demand bachelor’s level certifications specifically relate to security, general security clearance which is commonly requested by government contractors, and Certified Information Systems Security Professional (CISSP), a leading cybersecurity certification. Additionally, high demand for project management skills and experience leading agile teams are reflected in demand for Scrum and PMP certifications.

Table 7: Massachusetts Certification Demand, Computer Science Roles

Top sub- B.A. Certifications, Computer Science	Top Bachelor’s Level Certifications, Computer Science
Cisco Certified Internetwork Expert (CCIE)	Security Clearance
Project Management Certification (e.g., PMP)	Project Management Certification (e.g., PMP)
Cisco Certified Network Professional (CCNP)	Scrum
Security Clearance	Certified Information Systems Security Professional (CISSP)
	IT Infrastructure Library

Skill Demand for B.A. and sub-B.A. Computer Science and IT Jobs

Skill demand for sub-baccalaureate computer science jobs is much more focused on customer service and project management, while B.A. Positions are more likely to request programming and team management skills such as Python, C++, Agile development, and Scrum. Core software skills, such as software development, SQL, software engineering, and Java, are in demand across B.A. and sub-B.A. roles and therefore represent entry-level, cross-cutting skills.

Table 8: Skill Demand for Computer Science Occupations

Highest Demand sub-B.A. Skills	Highest Demand B.A. Skills
Software Development	Software Development
SQL	Software Engineering
Project Management	JAVA
Customer Service	SQL
Software Engineering	LINUX
JAVA	JavaScript
Scheduling	C++
JavaScript	Project Management
Budgeting	Python
Microsoft C#	Object-Oriented Analysis and Design (OOAD)
Technical Support	Oracle
.NET Programming	Microsoft C#
Customer Contact	Scrum
Supervisory Skills	UNIX
Information Systems	Extensible Markup Language (XML)

Within IT occupations, the skill demand varies substantially between education levels. Sub-baccalaureate roles call for basic customer service and technical support, as well as very technical, front-line skills for supporting an office or network system. These include networking skills, and installation skills. At the bachelor’s level, the skills are more closely connected to programming skills, specifically skills related to working with Oracle systems. The sub-baccalaureate skill demand also reflects computer support specialist roles hired within retail environments to support individuals with their computer needs.

Table 9: Skill Demand for IT Occupations

Highest Demand sub-B.A. Skills	Highest Demand B.A. Skills
Customer Service	SQL
Technical Support	Project Management
Cisco	LINUX
Repair	Technical Support
Network Engineering	Oracle
Routing	Software Development
Hardware and Software Installation	JavaScript
Wide Area Network (WAN)	JAVA
Retail Setting	Customer Service
Switches	Information Systems
LINUX	Systems Engineering
Project Management	Business Process
Help Desk Support	Python
Sales	UNIX
Routers	Software Engineering

Adjacent Occupations

In addition to the computer science and IT roles discussed above, the demand for computer science skills extends to a range of non-technology jobs. While these positions do not require the same depth of programming expertise as Software Developers, they highlight the breadth of demand for the types of programming skills that are developed through computer science education.

The occupations in this cluster are analysts, data-driven marketing professionals, and engineers. In these roles, the ability to program often makes candidates more attractive to employers. In addition to the demand for these roles, they are growing as much as 25 percent faster than the overall market⁵, indicating an increasing need for computer science beyond typical technology jobs, as these employers compete for much of the same talent.

Table 10: Additional Occupations Requiring Computer Science Skills

Occupation	Massachusetts Postings
Business / Management Analyst	7,432
Marketing Manager	5,691
Financial Analyst	4,477
Mechanical Engineer	3,095
Product Manager	2,945
Electrical Engineer	2,697
Marketing Specialist	2,190
Data / Data Mining Analyst	2,178
Engineering Manager	2,149
Chemist	1,797

Conclusion

Technology jobs continue to be a crucial component of the Massachusetts economy. IT and computer science roles, as represented in the Department of Higher Education's *Technology Talent Initiative: Workforce Plan*, represent more than 13 percent of the commonwealth's workforce demand, while commanding strong salaries. IT-adjacent roles calling for a similar set of technical skills represent an additional 9 percent of the workforce. Employers are having a difficult time filling this large set of jobs, as seen in both the *Workforce Plan's* findings and the time it takes employers to fill jobs as shown in this report. This examination of the demand of technology jobs tells Massachusetts leadership three significant takeaways:

- **Bachelor's degree requirements add difficulty for employers to source talent in a tight market.** Employer demands for bachelor's degrees make positions more difficult to fill. A strong, sub-baccalaureate pool of candidates with the appropriate skills and certifications could help close this workforce gap.
- **IT-adjacent occupations draw talent from the same workforce.** As employers compete to fill their technology workforce needs, they compete simultaneously with employers hiring analysts, supply chain specialists, and similar roles that require technology skills applied in a different setting. The

⁵ *Beyond Point and Click: The Expanding Demand for Coding Skills.* Burning Glass Technologies. June 2016.

workforce system must prepare for a broader technology workforce than the traditional roles laid out in the *Workforce Plan*.

- **Certifications offer opportunities for workers to differentiate themselves in the market and advance more rapidly.** The bachelor's-level demand for certifications, with emphasis on cybersecurity and project management, demonstrates important targets for the Massachusetts workforce system and employees. Attainment of these certifications, and of networking certifications at the sub-baccalaureate level, provide pathways into higher paying jobs.

Next Steps Recommended by Achieve

To meet the demands of the Massachusetts job market and increase the number of qualified candidates in the computer science field, state education and workforce leaders should consider a number of steps in the context of, and in coordination with, the commonwealth's ongoing efforts to promote college and career readiness for all students, as well as its more focused state plan for computer science and its [Early College Initiative](#), a program that facilitates partnerships between Massachusetts high schools and higher education institutions. More specifically, state leaders should:

Define and clarify the pathways to technology jobs and careers in Massachusetts. Education leaders in Massachusetts should ensure that students who want to pursue a postsecondary career in computer science know what pathways will prepare them for success in college or a career. They should build on the Massachusetts Department of Higher Education's 2014 [Technology Talent Initiative Workforce Plan](#), which demonstrates the critical need for more computer science postsecondary graduates to fill the necessary demand and includes a call to action to, among other things, convene members of the education community around program capacity and alignment, continue data analysis, and promote student interest in computer science in K–12.

Because computer science and mathematics comprise a significant component of the preparation necessary for all STEM careers, education leaders in Massachusetts should clearly define the pathways that provide opportunities for other rapidly growing STEM fields. This will help foster the ongoing integration of initiatives to increase the pool of qualified applicants for computer science and IT positions with efforts to strengthen the STEM talent pipeline overall. It will also help students who take computer science courses in high school see the range of postsecondary learning and career opportunities they can consider.

Define the appropriate role of computer science courses in MassCore. As the [State of the States Landscape Report: State-level Policies Supporting Equitable K–12 Computer Science Education](#) notes, computer science knowledge and skills are foundational for an educated community and essential for economic growth, yet one of the significant limitations of the field is the homogeneity of the workforce. This is likely in part due in part to a lack of both access to and interest in computer science for all K–12 students in Massachusetts.

One way to address this is to determine how (or whether) computer science fits into MassCore. An appetite for this discussion already exists: the Massachusetts Department of Elementary and Secondary Education wrote in its April 2017 [Consolidated State Plan Under the Every Student Succeeds Act \(ESSA\)](#) that the state intends to “accelerate [its] focus on computer science through... the possible inclusion of computer science in MassCore.”

MassCore is the state defined college- and career-ready program of study that is substantially aligned to admissions requirements in public four-year colleges. It includes four units of mathematics, three units of lab science, two units of the same foreign language, one unit of an arts program, and five additional “core” units, such as health, career and technical education (CTE), or business courses. The program of study sends a strong signal to students about the courses they must take to be prepared to enter and succeed in higher education, and has helped to increase the number of Massachusetts students who successfully complete those courses. At present, computer science is not explicitly included in the MassCore recommended program of study. Appropriately including computer science in MassCore can help increase participation and encourage the growth of computer science in earlier grades.

According to a recent [Education Commission of the States report](#), 20 states allow students to fulfill mathematics, science, or language graduation requirements with a computer science course. Massachusetts discourages students from substituting science or technology courses, including computer science, for the recommended four units of mathematics. In the decade since MassCore was established, the need for computer science in the work force has increased significantly, but the demand for scientific literacy and quantitative reasoning has increased as well. Therefore, whether to allow computer science to substitute for current mathematics or science requirements, or to find a different approach to incorporating it into MassCore, must be considered in the light of the collaborative effort of employers, higher education, and K–12 leaders to define curricular pathways through high school and postsecondary education. This process will help clarify and make transparent the mathematics and science skills needed for pathways to technology careers, as well as other STEM fields, so that students graduate from high school with the foundation in computer science, mathematics, and science they will need to pursue the careers of their choice.

Moving forward, representatives from the K–12, higher education, and business communities in Massachusetts should come together to identify ways to increase access to computer science, define pathways to successful postsecondary experiences, and signal the value of computer science education in K–12 education, positioning students in Massachusetts to be well prepared for 21st century jobs.

Methodology

To provide the information contained in this report, Burning Glass accessed its comprehensive database of 27 million online job postings collected in 2016. Burning Glass's spidering technology extracts information from close to 40,000 online job boards, newspapers, and employer sites on a daily basis and de-duplicates postings for the same job, whether it is posted multiple times on the same site or across multiple sites. Burning Glass's proprietary data is supplemented and contextualized by additional indicators from the Bureau of Labor Statistics and other published sources. All data is sourced from Burning Glass except where indicated. Burning Glass data in this report reflects all job postings collected in 2016.

About Burning Glass

Burning Glass Technologies delivers job market analytics that empower employers, workers, learners, and educators to make data-driven decisions. The company's artificial intelligence technology analyzes hundreds of millions of job postings and real-life career transitions to provide insight into labor market patterns. This real-time strategic intelligence offers crucial insights, such as which jobs are most in demand, the specific skills employers need, and the career directions that offer the highest potential for workers. Based in Boston, Burning Glass is playing a growing role in informing the global conversation on education and the workforce, and in creating a job market that works for everyone. For more information, visit burning-glass.com.

About Achieve

Achieve is an independent, nonpartisan, 501(c) (3) nonprofit education reform organization dedicated to working with states, districts, and partners on policies and practices to raise academic standards and graduation requirements, improve assessments, and strengthen accountability. Created in 1996 by a bipartisan group of governors and business leaders, Achieve is leading the effort to make college and career readiness a priority across the country so that students graduating from high school are academically prepared for postsecondary success.

APPENDICES

Appendix I: Occupational Breakdown

This table presents the occupations falling into the Computer Science and Information Technology (IT) job categories.

Computer Science and Management
<i>Chief Information Officer / Director of Information Technology</i>
<i>Computer Programmer</i>
<i>Computer Scientist</i>
<i>Database Architects</i>
<i>IT Project Manager</i>
<i>Mobile Applications Developer</i>
<i>Software Developer / Engineer</i>
<i>Software QA Engineer / Tester</i>
Information Technology
<i>Business Intelligence Analyst</i>
<i>Business Intelligence Architect / Developer</i>
<i>Computer Operator</i>
<i>Computer Support Specialist</i>
<i>Computer Systems Engineer / Architect</i>
<i>Cyber / Information Security Engineer / Analyst</i>
<i>Data Engineer</i>
<i>Data Warehousing Specialist</i>
<i>Database Administrator</i>
<i>Multimedia Designer / Animator</i>
<i>Network / Systems Administrator</i>
<i>Network / Systems Support Specialist</i>
<i>Network Engineer / Architect</i>
<i>Systems Analyst</i>
<i>Technology Consultant</i>
<i>Telecommunications Engineering Specialists</i>
<i>UI / UX Designer / Developer</i>
<i>Video Game Designer</i>
<i>Web Designer</i>
<i>Web Developer</i>
<i>Webmaster / Administrator</i>

Appendix II: Geography

Demand for technology jobs is heavily concentrated in the eastern part of the commonwealth, with more than two-thirds of all demand in Suffolk and Middlesex Counties.

