ARMENIA
2021-2041
ideas in action

Armenia
2021–2041

Project Materials

May, 2021

This document is a summary developed in partnership with "ARMENIA 2041" Charity Foundation. We emphasize that McKinsey's role in the project was only in terms of data provision and conducting analysis

Table of contents – detailed vision by sector and by enabler

High Tech & Digital

High Tech & Digital – summary of diagnostic

Background

Armenia has been supporting the development of its high tech industry (primarily IT) over recent years, resulting in steady growth within the industry (~20% p.a.) and an increasing number of IT companies (~800), primarily focused on IT services, software & web development

Economic contribution

	2019	Δ2014–'19
GDP, USD mln	455	+23% ▲
Employment Headcount, thou	31	+54% ▲
Productivity Gross value added/ employee USD thou	14.6	-20% ▼

Sector-specific KPIs

	Armenia, 2019	**Armenia**, 2014–'19 change		**Peers average**, 2019	**Leader-peer**, 2019
# of IT companies	800	+210%	▲	15,000	56,000
% of people employment in IT	2.9%	0 p.p.	▶	2.3%	3.3%
% of IT services in export	7.0%	-8.64 p.p.	▼	3.18%	7.0%
% of R&D expenditures in GDP	0.2%	0 p.p.	▶	1.0%	1.9%

> There are 3 leading accelerators in Armenia, providing services to 30–40 start-ups annually, as opposed to 14 leading accelerators in Estonia reaching 150 start-ups
>
> **Tech Expert**

> Armenia has historically enjoyed strong STEM higher education, but to continue succeeding in IT it is crucial to develop computer science education
>
> **Tech Expert**

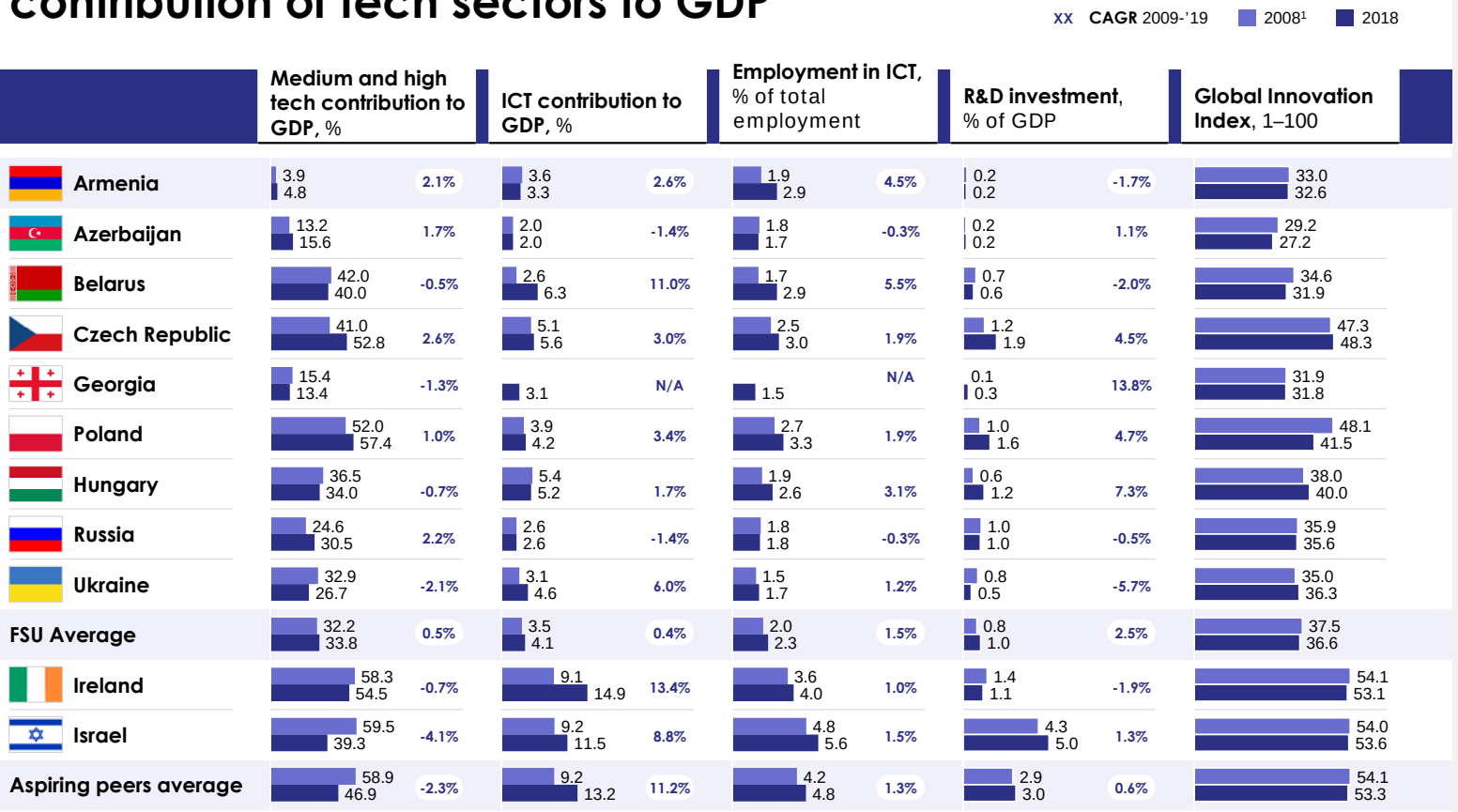
> IT companies and start-ups are heavily concentrated in Yerevan as other cities do not provide attractive infrastructure
>
> **Tech Expert**

ARMENIA 2021-2041 ideas in action

Key challenges and success factors

1. **Thrive in post-COVID environment**
   The spread of remote working due to COVID-19 is creating an opportunity for IT exports that Armenia can capitalize on
2. **Country-wide infrastructure**
   Development of remote cities to attract talent and IT company headquarters
3. **Futureproof education**
   Adoption and improvement of computer/data science education will enable further growth of high-profile IT exports
4. **Investment climate**
   Improvements in ease of doing business and legislation are essential to boost capital inflow
5. **Further growth of accelerators**
   Establishment of additional start-up incubators and accelerators with a strong focus on competence sharing and support

The significant gap in R&D and innovation between Armenia and peer countries limits the potential contribution of tech sectors to GDP



1. 2009 and 2019 respectively for medium and high tech GDP contribution; 2010 and 2019 respectively for ICT GDP contribution 2011 and 2020 respectively for Global Innovation Index

Source: World bank, Eurostat, National statistics agencies

Key considerations

R&D expenditure in Armenia needs to be **increased significantly (by up to 20 times)** to boost economic growth

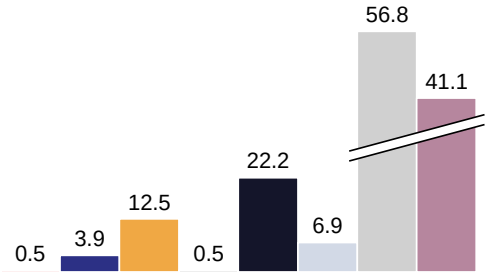
Tech sector **contribution to GDP is the lowest in the peer group due** to the absence of manufacturing capabilities, limiting output to IT services

Labor productivity in Armenia's ICT sector is significantly lower than in peer countries

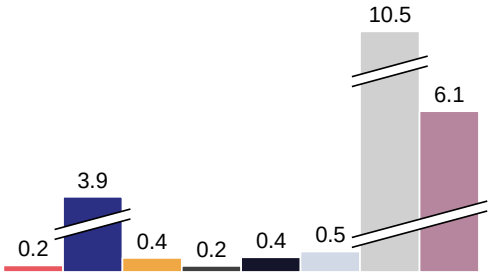
ARMENIA 2021-2041 ideas in action

Detailed in Enabler section

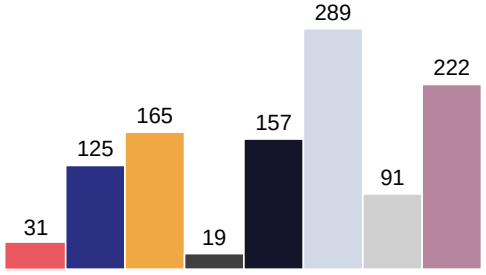
ICT Gross Value Added, USD bn



Revenue per company, USD mln



Number of employees, thou ppl

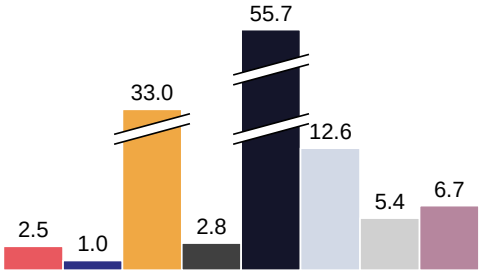


Armenia
Belarus
Czech Republic
Georgia
Poland
Ukraine
Ireland
Israel

High ratio of expat employees in Irish & Polish Big Tech HQ's could explain abnormally high labor productivity as they are not accounted for in employment statistics

1

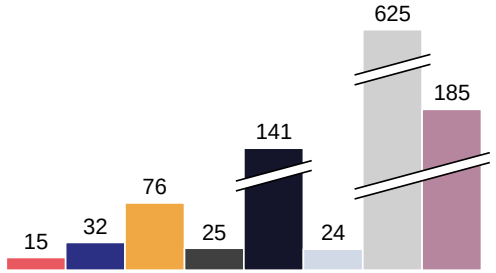
Number of ICT companies, thou



2

Detailed later

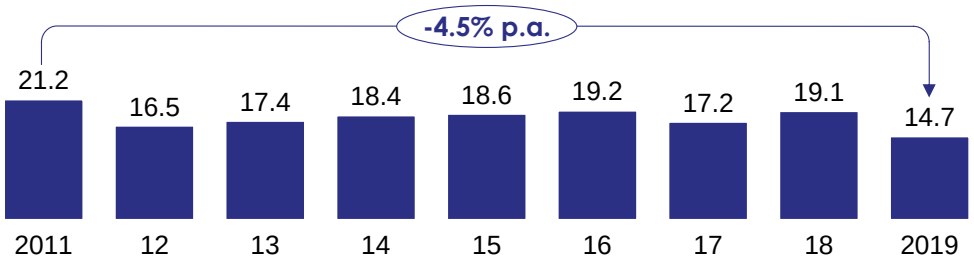
Labor productivity, USD thou per capita



1. ICT sector growth in Armenia faces a significant obstacle in the form of low and slowly declining labor productivity

Labor productivity in ICT has been falling over the past years…

Labor productivity 2011–2018, USD thou per capita



… for several possible reasons

Low value added of services provided

Armenian focus on low-cost IT-BPO services drives margins down

Lack of high-profile specialized education

Strong historic STEM education is not complemented by world-class data / computer science and business majors

Inefficient business processes

Lack of a knowledge-sharing ecosystem can lead to inefficiencies in operating models, resulting in higher overheads

Potential productivity improvement levers

Value proposition focus shift

Transforming the business model by moving away from traditional service-line oriented IT-BPO services towards tailored and use-case based solutions will help to improve margins (detailed further in the Trends & Vision section)

Doubling down on education

Developing and promoting world-class secondary and tertiary education programs with a focus on business, data science and engineering will provide stronger talent to create more value for consumers

R&D scaling

R&D should be perceived as a key source of innovation and, consequently, of high value-added propositions. Financing research and promoting innovation research and commercialization can unlock productivity growth (Israel example)

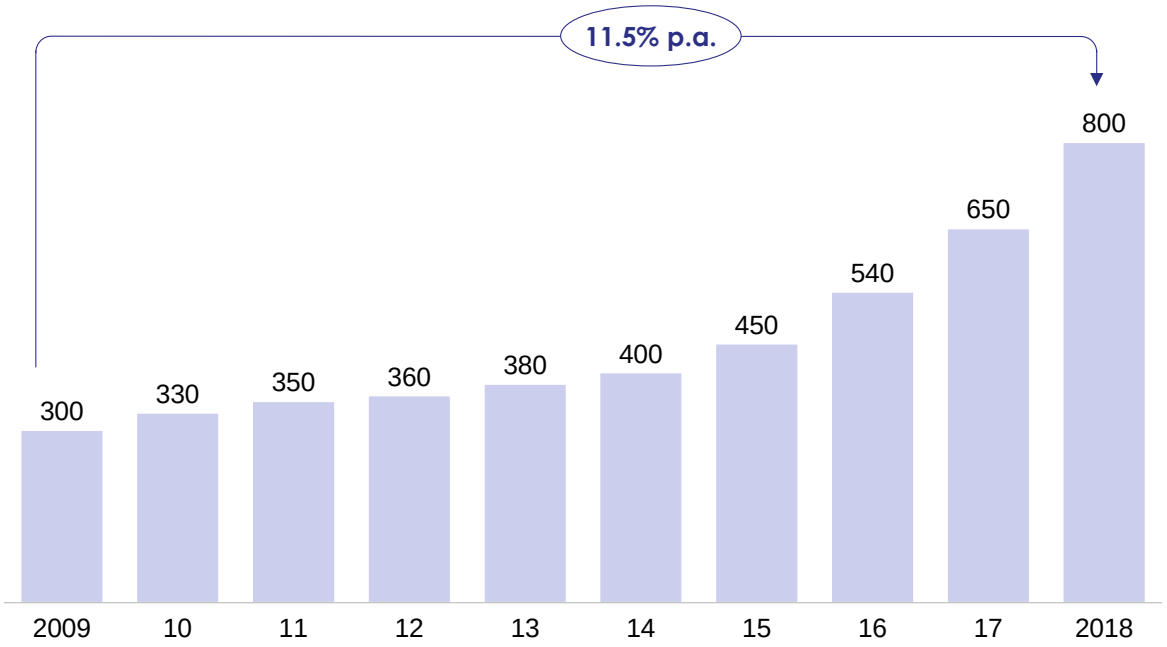
Start-up ecosystem

Growing the network of innovation hubs and start-up accelerators with strong mentoring and leadership programs will help IT companies run more efficiently

2. The number of IT companies in Armenia has been growing steadily, mostly due to the large number of new entrants

Armenia has seen the number of IT companies almost triple in the last 10 years…

Number of IT companies in Armenia, 2009–2018



… supported by government infra-structural and legislative measures for IT and tech companies

Establishment of an attractive tax and legislative climate (10% income tax and 0% profit tax during the first three years of operation) that attract established techno-logy firms and stimulate new start ups

Establishment of 4 Free Economic Zones to promote the development of the luxury, high tech, and industrial sectors

Armenia 2020 viewed the IT sector as pivotal to Armenia, suggesting education and infrastructure modernization

ARMENIA 2021-2041 ideas in action

Armenia National vision

2020

2031

The report paid particular attention to the nation's burgeoning IT sector, suggesting:

Modernization and consolidation of the post-Soviet education system to facilitate the ability to respond to ever-changing economic circumstances

Creation of a welcoming environment that could help attract large multinational tech corporations

Improvement of Armenia's public utilities and telecommunications services, providing a larger proportion of citizens with cellular and Internet connections

The Updated Plan took into account events from 2004 to 2015, further clarifying that:

Availability of talent and a low cost base make Armenia a possible outsourcing destination for programming and IT services

Stronger sectoral growth is hindered by inadequate supply of skilled IT graduates, access to financial resources, and a lack of external sector recognition at the global level

Table of contents – detailed vision by sector and by enabler

High Tech & Digital

Four key trends will shape the tech industry in the coming years

ARMENIA 2021-2041 ideas in action

Key trends

1 **Expansion of new buying centers beyond CIO (e.g., CFO, CDO, COO)**

While CIOs are likely to continue focus on cost efficiency, the new CXO buyer cohort is expected to focus on growth

2 **Use-case focused solutions replacing traditional service lines**

Customers are looking for **integrated**, not technology specific offerings (e.g., 'omni-channel experience' delivered through UI/UX, app dev, infra, cloud technologies)

3 **New entrants competing with large MNCs**

Digital attackers are replacing established large enterprises and **emerging as a new set of customers** for IT BPO service providers (e.g., Facebook, Google, etc.)

4 **Diminishing competitive advantage of the low-cost model**

The low-cost labor model is no longer a primary source of differentiation – onshore players have caught up with their offshore peers, and digital attackers are differentiating their offerings v/s commoditized legacy services

5 **COVID-19 changes the industry**

The impact of COVID-19 is expected to change buying behaviour (e.g., greater ROI), service requirements (e.g., resilient offerings) and the fundamental mode of operation for IT BPO players (e.g., remote working as the new normal)

Implications for Armenia

Quickly growing segment of non-CIO buyers should be prioritized by Armenian service providers due to higher value-added potential, faster growth of the segment and lower competition

Focusing on specific use-cases and industrial applications of technologies in R&D efforts could enable Armenia to enjoy higher margins and gross value added as opposed to general technology development

Rapidly shifting competition structure and a large number of successful new entrants could create an opportunity for Armenian start-ups to capture value on the global market

The historical model of Armenia providing low-cost IT outsourcing services is quickly losing its upsides, creating an urgent need to shift towards intellectually intensive and highly differentiated solutions

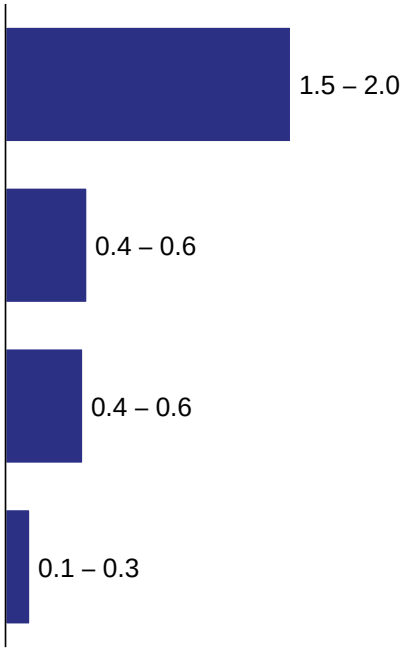
In the short run, Armenia should prioritize industries least affected by COVID-19 (telecom, healthcare, insurance and financial services), while focusing in the medium term on recovering industries (energy, retail) could enable accelerated growth

1: 50%+ of spend is likely to be driven by non-CIO buying centers with a focus on growth

The new cohort of CXO buyers will own ~50% of the IT spend wallet by 2025

	Buyers & Spends
Core IT market	**CIO:** Traditional core IT and new IT (e.g., SaaS, private cloud)
Digital marketing	**CMO, Chief Commercial Officer, Head of Product/Service:** Pricing, CRM, Churn reduction
Digital operations	**COO, Chief Risk Officer, Product Heads**: Automation, Analytics, SCM digitization
Corporate functions	**CFO, CHRO, CSO:** Investment analytics, People analytics

TAM by 2025, USD bn



Source: NASSCOM Perspective 2025 report, IDC 2017 WW Semi-annual digital transformation spend, IDC technology spend guides

ARMENIA 2021-2041 ideas in action

Key considerations

While CIOs remain a large buyer cohort, **faster growth** and higher demand for **differentiated products** (detailed further) among business functions make them a favorable clientele

2: Use-case focused solutions will become predominant in digital, with a strong focus on delivering ROI to enterprises

Customers are looking for an integrated proposition across service lines for 'business back' use-cases rather than 'offering-led' propositions

Digital use-cases	Enterprise use-cases	Offerings involved
Connect	Use of digital channels to enhance customer experience (e.g., omni-channel purchase and checkout process in e-commerce)	UI/UX Omni-channel Digital marketing
Automate	Reduction of costs and errors and improvement of customer satisfaction (e.g., self-service onboarding for banking products)	RPA Digital system integration
Decide	Big-data analytics-led insights to drive decisions (e.g., frequency-lead CVM use-cases in retail	Analytics AI IoT
Innovate	Product / service and business model innovation (e.g., AR-enabled fitting room for fashion retail)	Digital product engineering

Source: McKinsey Global Institute; McKinsey 2016 Digital Strategy Global Survey (n-2135), CXO interviews

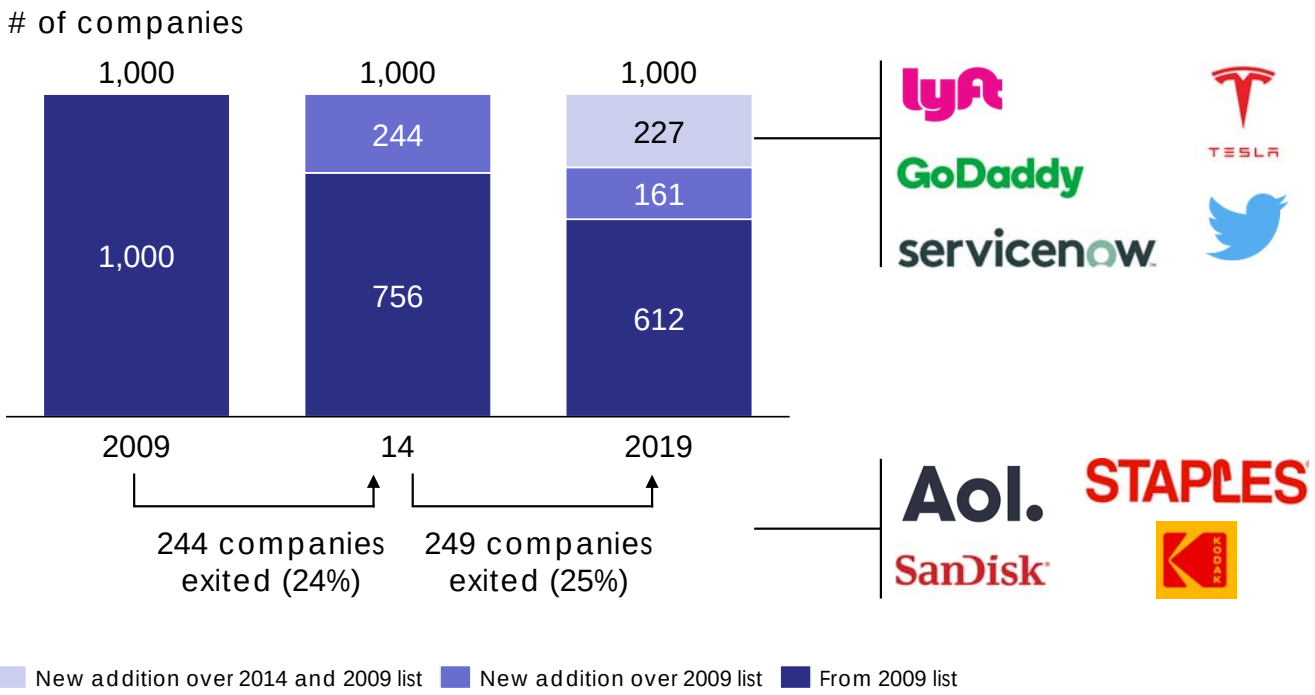
ARMENIA 2021-2041 ideas in action

Key considerations

Shifting the focus from delivering a broad range of IT BPO service offerings towards **tailored use-case based solutions** should be the key narrative for the ITC industry in Armenia to **boost labor productivity** in the years to come

3: Digital attackers are disrupting established large enterprises and capturing a greater share of the new revenue

Fortune 1,000 has seen dramatic changes in structure over the last decade



1. 612 companies featured in both 2009 and 2019 list

Source: Fortune 1,000 lists; press research; team analysis

ARMENIA 2021-2041 ideas in action

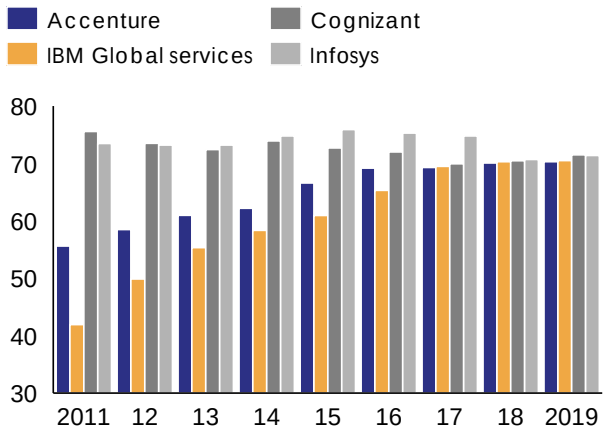
Key considerations

- Only ~75% of companies from 2014 are still in the list; the rest have churned out
- The new entrants are being led by digital attackers who are able to generate value at a much faster rate than traditionally seen
- The success cases of new entrants confirm that there are opportunities for Armenian start-ups to capture value

4: Global MNCs are becoming cost competitive; revenue growth continues to decouple from headcount growth

Increasing offshore presence for Global MNCs

Offshore employees as a % of total, 2011–19

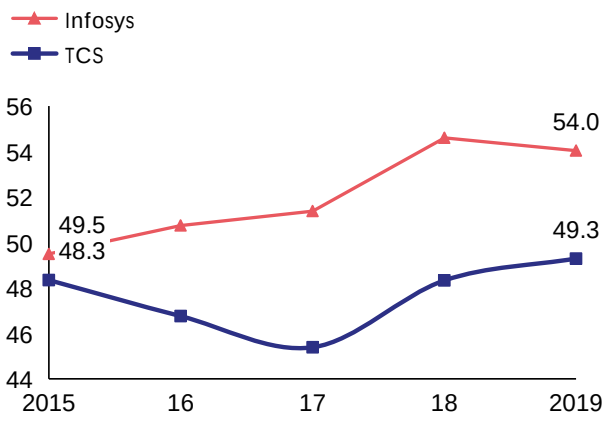


Global MNCs have steadily **increased** their offshore presence over the last decade to compete with Indian Tier 1s

Cost arbitrage is no longer a significant advantage for the Indian Tier 1s

De-coupling of revenue growth from headcount growth

Revenue per FTE, USD thou, 2015–19



Revenue productivity has been improving across the industry for 2 reasons –

- **Automation:** Increased automation and lean practices have improved revenue productivity despite pricing pressures
- **Differentiated pricing for digital:** Digital revenue comes at an inherently higher revenue / FTE

Source: NASSCOM, ICRIER, Team analysis, Annual reports (Infosys FY11 to FY20, Cognizant CY18, CY19), Bernstein report, Factsheet TCS

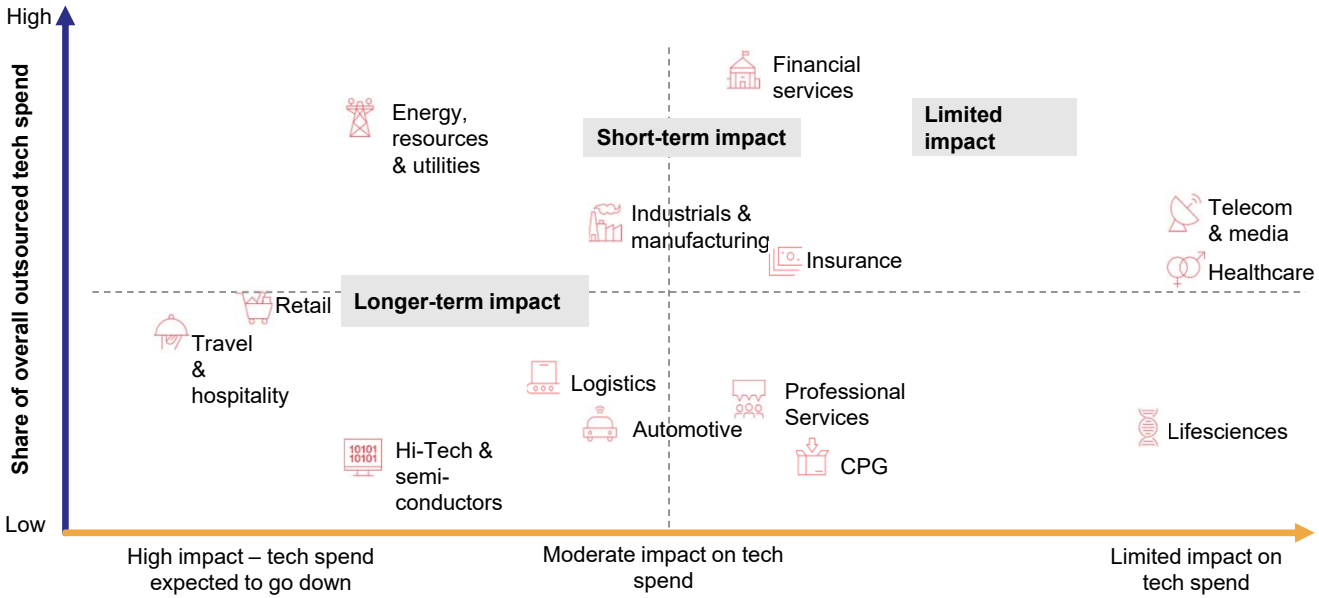
ARMENIA 2021-2041 ideas in action

Key considerations

- **The low-cost IT BPO** model that has historically been a source of growth for Armenia is quickly **losing its potential,** calling for immediate change
- A shift to **high value-added solutions** could help **unlock productivity potential** for Armenian IT companies

5: The impact of COVID-19 on technology spending will vary by industry and lead to new priorities anchored on digital

COVID-19 impact by industry



Source: Team analysis

ARMENIA 2021-2041 ideas in action

Key considerations

CIO insights on spend trends in light of COVID-19 point to a need for providers to focus on '**resilient' offerings,** such as:

- Cloud, workspace transformation and cybersecurity across verticals
- Omnichannel engagement and store of the future for Retail and CPG
- Digitized claims management for BFSI
- Digital physician engagement and tele-medicine for Healthcare-Lifesciences

Vision for Armenia's tech industry

ARMENIA 2021-2041 ideas in action

2017 → 2031 → 2041

$0.5 → $1.9 → $10.2 bn Target ICT export

31 → 127 thou required workforce

Overarching principles

- Focus on productivity growth through high value-added products & process automation
- Develop use-case specific solutions for business functions (CMO, CXO, COO, etc.)
- Shift the focus away from the low-cost outsourcing model to protect revenues

Key industries

- Telecom & media
- Healthcare
- Financial services
- Insurance
- Industrials & manufacturing
- Energy, resources & utilities
- Retail
- Defense
- Agriculture

Key geographies

>40%

Of global ICT imports are generated by 6 countries largely due to leveraging outsourced/ outstaffed services by local IT companies

Key technologies

Detailed later

- Advanced Analytics and AI solutions
- AR/VR business applications
- Semiconductors and IoT devices design
- Robotics
- Cloud computing services

The following 8 technologies have been identified as the most impactful over the next 20 years

High-impact technologies	Current trends	Main applications
Cloud-based computing and services	Enterprises are migrating towards cloud-based modular technology architecture, however, the pace of migration is expected to vary by workload level and enterprises will continue to adopt a multi-vendor strategy	Education, Agriculture, Defense, IT services
3D Printing	3D printing allows just-in-time production, manufacturing of completely customized products, and rapid prototyping. As technology develops, 3D printing is enabling manufacturing of car parts, prosthetics and even organs	High tech manufacturing, Healthcare
High-speed telecommunication (5G networks)	5G networks enable fast internet access at a bandwidth comparable with cable connection for mobile devices, making remote work even more accessible	Education, Agriculture, Defense, IT services, Tourism, Telecom
AR and VR	As processing hardware develops, AR and VR applications are getting closer to seamless experience, enabling a broad spectrum of activities in live remote mode, further boosted by COVID-19	Education, Agriculture, Defense, IT services, Tourism
Robotics and drones	Automation and manufacturing through robots brings ~75% improvement in productivity and is expected to generate ~USD 2–7 trillion in economic impact by 2025	High tech manufacturing, Agriculture, Defense
Internet of Things (IoT)	IoT helps improve the operational productivity of business through automation and enables new services, products (wearables, smart home, etc.) and strategies	Healthcare, Agriculture
Blockchain	Blockchains are immutable & distributed ledgers that can be maintained without the need for any central authority, offering a secure, decentralized solution that maintains data redundancy and integrity	Healthcare, Telecom, IT services
Advanced Analytics and AI	AA is gaining momentum as it helps foster better evidence-based decision making and improved business outcomes at a time where consumers' expectations are high and companies are becoming more efficient	All sectors

Prioritization of key technologies is based on several factors (detailed further)

ARMENIA 2021-2041 ideas in action

Priority technologies | Favorable conditions | Neutral conditions | Unfavorable conditions

	Technology market size in 2019, USD bn	Projected 10-year CAGR, %	Capital intensity of technology	Risk level	Existing competencies	Strategic importance
Blockchain	2	56%[1]	Low investment	Legal status uncertainty	Lack of competency	Low
5G networks	6	122%[1]	Infrastructure – heavy	Partner dependency	Moderate competency	Moderate
3D printing	14	30%	Moderate investment	Low risks	Moderate competency	Moderate
AR/VR	20	76%[1]	Moderate investment	Low risks	Moderate competency	Low
Robotics	104	26%	Infrastructure – heavy	Low risks	CPU design know-how	High (agriculture & security)
IoT	250	25%	Moderate investment	Low risks	CPU design know-how	High (agriculture & security)
Cloud	265	16%	Moderate investment	MNC competition	Moderate competency	Moderate
AA/AI	327	16%	Low investment	Low risks	Extensive research	High (agriculture & security)
Total ITC market size	~4,300	5.6%				

1. 5-year CAGR

Source: Businesswire, team research, expert interviews

1. Demand for cloud computing is surging, as 75% of CIOs are looking to move 40%+ of apps to the cloud

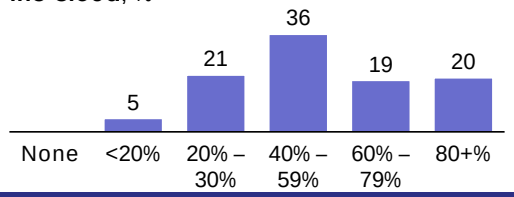
ARMENIA 2021-2041 ideas in action

Market size and potential

Source: IDC

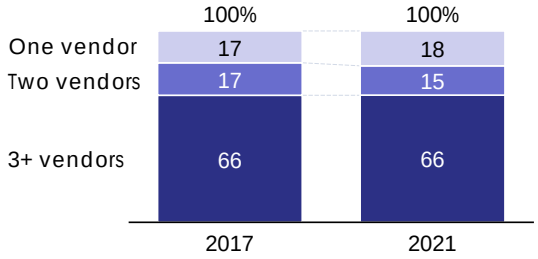
75% of CIOs are planning to move 40%+ of their applications to the cloud

IT applications planned to be migrated to the cloud, %



Leaders will continue to pursue a multi-vendor cloud model

Multi-vendor cloud usage, 2017 – 2021, %



> A multi-vendor strategy is almost essential at this point. You don't hear of a lot of companies with only a single provider. AWS definitely still leads, but I could imagine a world in which Azure's trend line catches them

– Fortune 100 CIO

Cloud services in Armenia

- Promotion of cloud computing requires substantial investment in hardware (primarily server infrastructure) creating an obstacle for its development in the country
- The level of education in mathematics in engineering provides a strong knowledge base for the development and maintenance of cloud infrastructures

Current representation in Armenia

ServiceTitan

WICASTR® The SMART Edge Platform

2. Advanced Analytics and AI is one of the most promising sectors of technology development

Market size and potential

Source: IDC

Best implementation practices

Cyber Valley in Tubingen, Germany

- Established in 2016 as the European Center for Artificial Intelligence
- Developed as an additional graduate program offering to Max Planck University, a leading German STEM institution
- Partnered with federal officials to better leverage financial and intellectual resources
- Functioned as an accelerator for start ups focused on development and AI integration

National AI Strategy, Singapore

- Established in 2019 as an effort to facilitate AI integration and adoption
- Targeted five national AI projects, including transport and logistics, smart cities and estates, healthcare, education, and safety and security
- Founded an Ethical Advisory Board to ensure compliance with strict regulations
- Utilizes a triple helix model of partnership between the research community, industry and government

Advanced Analytics and AI in Armenia

- A strong mathematics and computer science educational base facilitate talent development in AA/AI
- Availability of industry specific conferences at national level (Develandoo)
- There is strong potential for cross-sector applicability across all the major economic sectors, such as healthtech, e-agriculture, and e-education

Current representation in Armenia

krisp

SuperAnnotate

3. Robotics is one of the most investment-heavy industries, yet it has a high strategic importance in Armenia

Market size and potential

Source: Statista

Best implementation practices

New Robot Strategy, Japan

- Established in 2015 as part of the diffusion of robots into every corner of daily life
- Coordinated effort between the public sector and private enterprises
- Created a regulatory environment that codifies robot usage technology and enhances robot usage in the society
- Proposed the integration of robots in manufacturing, agriculture, disaster response and the defense sector

National Strategy for Robotics, Bangladesh

- Established in 2020 in part as an effort to mitigate potential job losses due to the advent of national industry-disrupting technology
- Focused on Telerobotics (industrial internet of things (IIoT)) as a high-value service export for the remote monitoring, supervision and operation of industrial and service IoTs
- Proposed importing basic robots with the development of local customization tools to derive added value and impact

Robotics in Armenia

- Robotics offer cross-functional export possibilities in many fields
- To benefit from robotics without having to carry substantial manufacturing investment, Armenia should look into robotics design while outsourcing manufacturing to Russian or Chinese partners

Current representation in Armenia

expper

Instigate ROBOTICS

4. Existing capabilities in semiconductor design could help enter the steadily growing IoT design market

Market size and potential

Source: Fortune Business Insights

Best implementation practices

Advancement of IoT in Europe, EU

- Established in 2016 as part of an effort to create a united cluster ecosystem throughout the continent
- Developed standardized security protocols to ensure safety within the interconnected IoT ecosystem
- Created several pilot programs that can test IoT capabilities in projects ranging from logistics optimization to goods monitoring systems

IoT Action Plan, Brazil

- Established in 2017 by the Ministry of Science, Tech, Innovation, and Communication to accelerate the implementation of IoT as a tool for sustainable development
- Focused on IoT implementation in AgTech in order to increase productivity by 25% and reduce pesticide use by 20%
- Recommended the creation of Skill Centers to promote training of the young unemployed workforce as well as public managers

IoT in Armenia

- Semiconductors will play an extensive role in IoT development, allowing Armenia to utilize its already available experience in semiconductor design to gain an edge in IoT evolution
- Armenia can utilize extensive diaspora connections to further gain an edge in this developing field

Current representation in Armenia

HELTUN

Knightsbridge Wireless Communications

5. Blockchain is a high-potential industry, yet it presents a high degree of uncertainty due to its ambiguous legal status in most countries

Market size and potential

Source: Fortune Business Insights

Best implementation practices

Blockchain, The India strategy, India

- Established in 2020 as part of an effort to decentralize local environments from the federal government, facilitating local peer-to-peer interactions
- Suggested a standardized procurement process for government agencies to adopt blockchain solutions
- Explored the possibility of a pegged stable cryptocurrency coin for the Indian Rupee allowing seamless exchange within blockchain solutions

National Blockchain Strategy, Bangladesh

- Established in 2020 in an effort to advance Bangladesh's technical capacity, increase efficiency in e-Governances and foster innovation
- Creation of a blockchain expert board comprising experts, seasoned technologists, academics, and government officials
- Assessed potential blockchain applications in the context of the particular needs of a developing nation

Blockchain in Armenia

- Nooor blockchain association hosts conferences and educational workshops promoting the adoption of the technology
- Armenia does not have a large start-up presence in this emerging industry; entering the market would require significant investment in human capital
- The haziness of the regulatory environment is one of the biggest challenges to unlocking the potential value of blockchain

Current representation in Armenia

nooor
armenian blockchain association

6. Armenia has the potential to capitalize on rapid AR/VR industry growth through the development of industrial applications for existing hardware

Market size and potential

Source: Statista, Ecorys

Best implementation practices

UK VR/AR development strategy

- Granted £453,000 to a university-hospital partnership to work on a VR project helping stroke patients practice and re-learn daily activities
- R&D funding of £33 mln made available for immersive tech companies through 2018–19
- Digital catapult supports small businesses to create immersive content through funding, expertise, facilities, workshops and pitching opportunities

VR/AR innovation hub in Paris and Laval

- Laval Virtual Center – facility for VR start-ups for research, product testing and for start-up acceleration programs – opened in 2017
- Launched annual Laval Virtual Exhibition bringing together international talent in VR
- Launched Laval Virtual University offering remote and in-person training for VR/AR professionals

VR/AR in Armenia

- A number of VR start-ups in Armenia have secured funding (e.g., VR Labs and GenU Youth Challenge) and are developing VR applications in chemistry, tourism and entertainment
- Government support of VR/AR R&D in Armenia is rather limited
- No dedicated innovation hubs or acceleration programs exist in Armenia at the moment

Current representation in Armenia

arloopa

360 STORIES

7. 3D printing is an infrastructure-heavy industry with limited market potential

Market size and potential

Source: Mordor Intelligence

Best implementation practices

National Additive Manufacturing (AM) strategy, UK

- Established in 2017 as part of an effort to provide early mover advantage to UK SMEs in the aspiring 3D printing sector
- Developed recommendations to coordinate AM standards and testing procedures to ensure standards compliance
- Suggested a set of comprehensive IP laws with a particular focus on licensing, payment methods, design and collaboration

National Strategy for AM, India

- Established in 2020 in an effort to advance India's position as a global hub for AM development and deployment
- Created a national AM center that establishes a certification process, legal considerations, and academic collaboration guidelines
- Certified the national focus on R&D in electronic and photonic AM components, with particular attention to creating long-lasting economic partnerships in these fields

3D printing in Armenia

- Armenia has introduced AM technology in the education pipeline by providing state and privately sponsored Armarth labs with access to 3D printing technology
- While Armenia has some experience in AM, it would be challenging to remain competitive on the global market as it lacks economy of scale (compared to China, Japan, and South Korea)

Current representation in Armenia

AugmentAr

FOLDINK
LIFE SCIENCE TECHNOLOGIES

8. Armenian dependence on large Russian network providers creates a major obstacle to the development of a national 5G network

Market size and potential

Source: Allied Market Research

Best implementation practices

National Strategy to Secure 5G Implementation, USA

- Established in 2020 as part of a nationwide 5G deployment operation
- Developed standardized security protocols to ensure safety within the interconnected IoT ecosystem
- Created several pilot programs that can test IoT capabilities in projects ranging from logistics optimization to goods monitoring systems

National Cybersecurity and Cyberdefense strategy, Israel

- Established in 2017 in an effort to provide a structural defense strategy against external foes
- Developed an educational pipelineto provide cybersecurity training to conscripts participating in mandatory military service
- Fostered strong relationships between private network companies, public administration, and external allies (USA) to develop a cybersecure society

5G and telecommunications in Armenia

- Currently, Armenia is not well positioned to lead the 5G revolution as it lacks experience and underlying technology
- Network and cyber security are in the development stage in Armenia and can be attacked from abroad
- Armenia is heavily reliant on major Russian telecommunication companies for infrastructure procurement, thereby hindering the rapid implementation of 5G-enabled solutions

Current representation in Armenia

Table of contents – detailed vision by sector and by enabler

High Tech & Digital

To understand how to grow Armenia's high tech sector, multiple dimensions must be considered across the value chain

ARMENIA 2021-2041 ideas in action

High tech value chain	1 New Venture Establishment	2 R&D and product design	3 Product development and manufacturing	4 Product commercialization	5 Business scaling
Dimensions					
People and talent	Sufficiency, qualification and expertise of people employed in the hi-tech sector				
Infrastructure		How does existing infrastructure (cities, roads, electricity and internet) enable output in the agricultural sector?			
Ecosystem			Legal environment for IT companies, communities, knowledge sharing and acceleration programs aiding start-ups to establish and grow		
Capital & investments				Access to financing and resources for new venture establishment and development from government and private capital	

NON-EXHAUSTIVE

Supporting levers for high tech development in Armenia

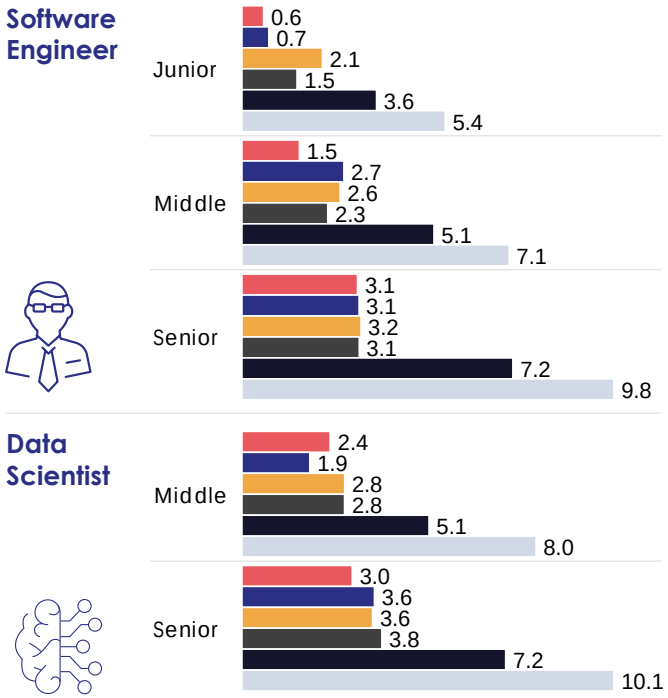
Less Critical ☐ ☐ ☐ Most Critical

Stage	New venture establishment	R&D & product design	Product design & manufacturing	Product commercialization	Business scaling
People and talent	**Local labor pool, compensation and incentives for IT/high tech talent to work in domestic companies** 1				
	Qualification of domestic talent within STEM and business field of knowledge 2				
	Leverage and attraction of international talent (entrepreneurs, specialists, experts) to speed up establishment and growth of businesses 3				
Infrastructure	Roads and transportation 4				
	Urban infrastructure (housing, food and services) in Yerevan and remote locations 4				
	Cell & cable internet coverage, quality and reliability 4				
	Start-up hubs: facilities and spaces for work, acceleration and incubation programs, coaching and mentorship 5				
Ecosystem	Start-up education and networking events			Technology roadshows & trade conferences	
	Start-up and SME legislation, ease of setting up and doing business			Legal framework & taxation of technology companies	
Capital & investments	**Government funding of research and technology commercialization** 6		Access to commercial loans		
	Access to venture & business angel capital for entrepreneurs primarily driven by FDI 7				

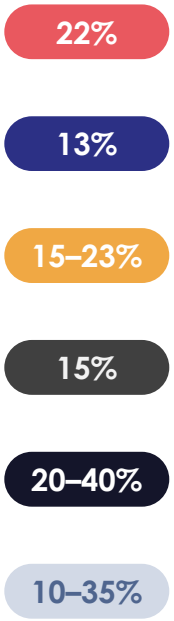
1. ICT labor resources in Armenia are comparable to the FSU level, yet low compensation is leading to a disparity with aspiring peers

Income for young IT specialists is considerably lower in Armenia compared to aspiring peers…

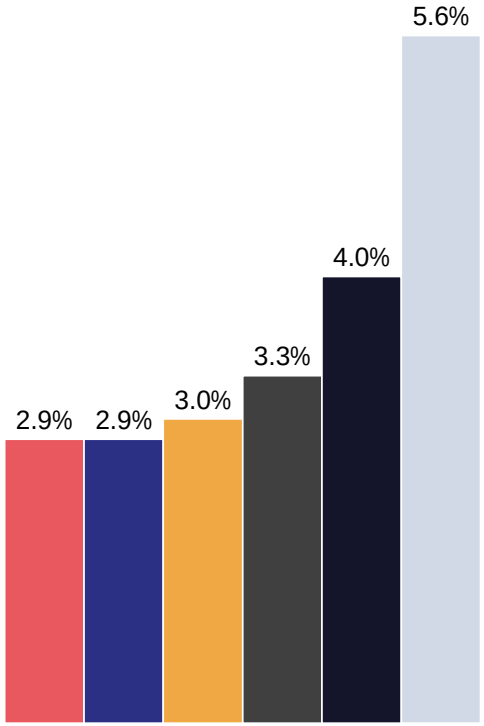
Average salaries in IT sector in 2020, USD thou



Tax rate, %



…resulting in lower engagement of the labor force in IT



Source: Glassdoor, National Statistics agencies, salaries.dev.by, itis.am

Key considerations

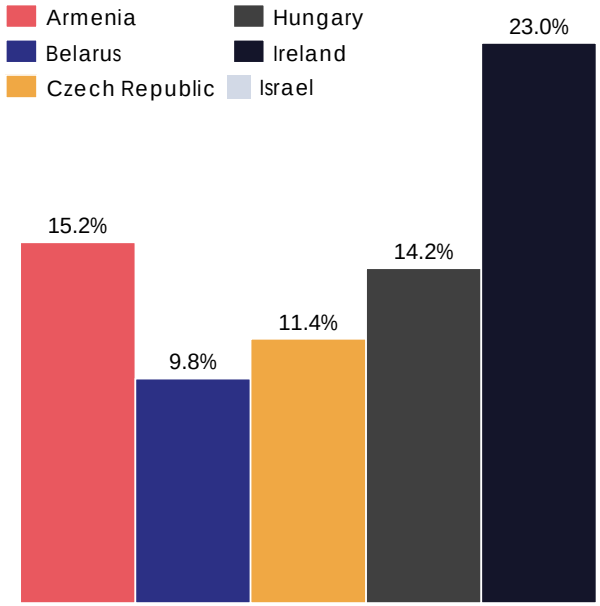
The compensation gap is particularly stark among **junior and mid-level specialists,** reducing incentives for young talent to work domestically

Investing in **higher compensation** to attract top talent will **enable a differentiated value** proposition, resulting in **higher labor productivity**

2. Despite having a steady flow of STEM graduates, Armenia lacks strong education programs in computer and data science

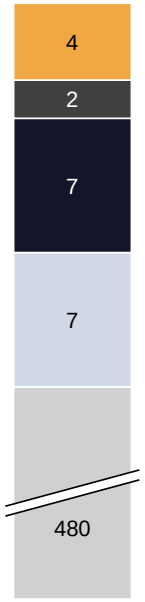
The ratio of STEM graduates in Armenia is slightly higher than in other FSU countries…

Share of STEM graduates in 2019, %



… yet none of its STEM/CS programs are in the global top 500

Top 500 Computer Science programs in 2020, %



	2019 QS Rank
Trinity College Dublin, The University of Dublin	89
Technion Israel Institute of Technology	103
University College Dublin, Ireland's Global University	151–200
Czech Technical University in Prague	201–250
The Hebrew University of Jerusalem	201–250

Sources: UNESCO UIS, QS Rankins, Eurostat

Key considerations

Development of **world-class higher education programs in priority areas** (computer science, data science, cybersecurity, business and entrepreneurship) is essential for the long-term supply of talent in the industry

Higher education can be complemented by **continuous learning/reskilling** programs for graduate specialists via **government-private partnerships**

3. Recruitment of foreign specialists could greatly accelerate the development of Armenia's technology sector

ARMENIA 2021-2041 ideas in action

Expats could be a strong addition to the talent pool…

Inviting foreign specialists to work in the Armenian IT sector could be a strong opportunity to expand the national talent pool in the relatively short-term, complementing national efforts to improve the quality of education

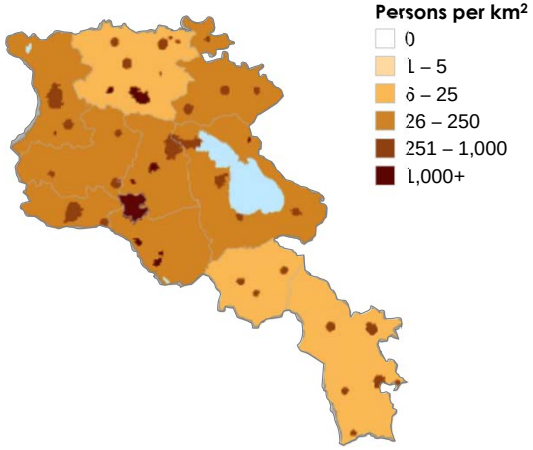
… which is leveraged by several economies

Factors affecting the country's attractiveness to external talent	Situation in Armenia
Preferential visa regimen for talent • Absence of visa requirements or simplified visa application and approval process	
Ease of starting/doing business • Low cost and absence of bureaucracy when starting a business, transparent policies	
Preferential tax regime for corporations • Low corporate tax rates and deductions • Low income tax rates and deductions	
Compensation • Competitive compensation for international talent • Higher income opportunities in comparison with home countries	
Infrastructure and quality of life • Developed urban infrastructure with amenities, services and housing • Access to high-speed broadband and strong cell coverage	
Language proficiency • Ability of large share of population to speak English / home country language	
Safety and political stability • Perceived lack of safety can act as a strong deterrent / reason for emigration of expat talent (Belarus example)	

Source: Central Statistics Office Ireland, Expert interviews, team analysis

4. Poor infrastructure is a major obstacle on the technological excellence pathway

Majority of population & economic activity is concentrated in Yerevan…



While the necessary infrastructure and amenities are in place in Yerevan, the rest of the **regions remain underdeveloped**

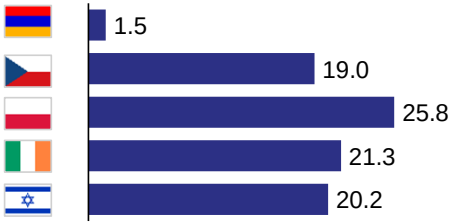
The **limited financial resources of local authorities** are considered one of the main obstacles to regional and local urban development in the country

A **gap in housing legislation** is creating significant barriers in the maintenance of aging housing stock

… while the low level of maturity of key infrastructure elements is impeding regional development

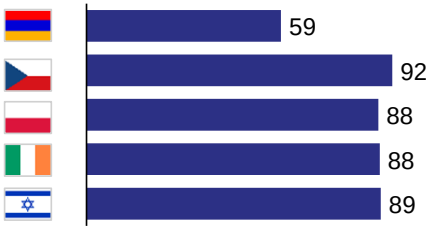
Internet connection

Average download speed, Mbps



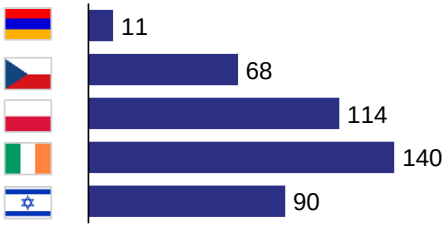
Road connectivity

Road connectivity index (100 – best)



Airport connectivity

Airport connectivity (score)



Source: Global Competitiveness Report, Fastmetrics, Asian Development bank

ARMENIA 2021-2041 ideas in action

Key considerations

- Development of comprehensive **urban infrastructure outside of Yerevan** will enable **regional development** and provide more opportunities for local and international talent to work in Armenia
- Improvement of **broadband network coverage and bandwidth** is essential to enable an **unobstructed workflow for IT specialists,** increasing Armenia's attractiveness as a place to work

5. Development of a hub and accelerator culture facilitates the promotion of technological excellence

Start-up accelerators, hubs and technology districts provide a wide range of functions

Supply of risk capital
Access to business angel and/or venture capital funding to capitalize on and commercialize technologies

Early stage funding
Strong focus on idea and pre-seed stages to support new entrants

World-class talent
Strong entrepreneurial residents with mature technology and business acumen

Strong mentorship
Access to experienced entrepreneurs and business professionals actively coaching and sharing knowledge on how to build a business with participating start-ups

Business support
Wide range of business-services: legal, market insights, consulting, etc,

Networking
Networking events and strong communities helping entrepreneurs get together, find commercialization opportunities, prospective partners and clients

> "There are approximately 10 start-up accelerators and 10 venture capital funds operation in Armenia"
>
> Tech expert

> "While start-ups have access to funds and acceleration programs, the survival rate of accelerator residents after 2–3 years is rather low"
>
> Tech expert

> "One of the key problems in acceleration programs at the moment is a lack of business education (how to test a hypothesis and develop a product, how to commercialize and scale a business) and strong mentorship"
>
> Tech expert

Source: Expert interviews. team research, Seaside summit

ARMENIA 2021-2041 ideas in action

Key considerations

Attracting and staffing **world-class entrepreneurs and business leaders to coach and educate start-ups** on product development, hypothesis testing, commercialization and scaling will increase the survivability and success rates of resident companies

5. Start-ups require the support of different stakeholders across their growth cycle

ARMENIA 2021-2041 ideas in action

Small firm

Incubators

Support start-ups in **creating the company**, validating the business model and building an initial roadmap

Provide access to own **network** of start-ups, mentors, events and co-working space

Accelerators

Support already established start-ups in developing and scaling their business

Provide tailored mentorship. training and seed investment

wayra. Start up Lisboa UPTEC

Business Angels

Invest own capital for a share of start-ups' equity in seed or early-stage businesses

Provide **professional experience**, often in exchange for a **position on the board**

REDangels BUSYANGELS VENTURE CAPITAL INVESTORS BANC madrid

Medium firm

Venture capital firms

Invest capital for a share of start-ups' equity in early to growth-stage businesses

Advise on companies' **strategic direction**

NAUTA CAPITAL SeayaVentures PORTUGAL VENTURES ARMILAR VENTURE PARTNERS

Consulting firms

Deliver **market and competitive insights**

Support start-ups in **scaling their businesses** and **optimizing their operations**

Promote access to a **pool of investors** and prepare start-ups for investment meetings

McKinsey & Company Deloitte. KPMG

Strategic alliances

Establish **partnerships** with relevant stakeholders (suppliers, distribution)

Broaden start-up **market access**

Large firm

Private equity firms

Invest capital for a share of mature companies' equity in the growth, late and restructuring stages

Play an important role in the ventures' strategy, often **defining the management team and crucial milestones**

EXPLORER INVESTMENTS ALANTRA

Corporates

Vertically integrate start-ups, internalizing their services in the corporate structure

Establish close relationships with ventures, providing **demand for their services**

Telefónica edp

Legal services

Support companies through **legal hindrances from the earliest stages** (constituting a venture) to the **exit strategy** (IPO/Acquisition)

TEAM GENESIS

5. Akadempark offers a case study of a successful technology park within the FSU

ARMENIA 2021-2041 ideas in action

Situation Overview

In 2006, Novosibirsk, a large research city in Russia, wanted to expand its famous research facility, Akademgorodok, with an integrated technological park with a unique technological and business infrastructure. The project was named "Akadempark"

The regional leaders wanted to create high-paying jobs for local talent by securing a global competitive advantage in selected areas

Action

Establishment of 4 core focus areas:

- Information technology
- Instrumentation and equipment
- Biotechnology
- Nanotechnology and new materials

Creation of a Special Economic Zone with a reduction in income tax from 20% to 15.5%

Establishment of national and international conferences that attract more than 25,000 participants annually

Impact

317	Start-ups and established firms
117	Residents of the business incubator
>10,000	Employees of resident companies
150%	Budget efficiency
USD 420 mln	Annual resident revenue

5. Silicon Wadi is a strong example of an innovative technological project outside of the FSU

Situation Overview

Tel Aviv wants to become a leading smart city by strategically implementing resident-oriented government, to maintain an appealing urban environment and to advance the city's status as a financial and cultural center

Government is focused on increasing the number of tech workers by producing engineers and scientists

Action

Increase in R&D spend as a percent of GDP. Israel reinvests 4.5% of its output back into research

Focus on higher education through IDF training in tech skillsets. Many of the technological products created in Israel have their origin in military technologies

Provide up to 40% of additional capital to that raised by outside investors along with legal incentives to spur growth

Impact

4,700	Start-ups
>100	Resident VC funds
>35,000	Employees of resident companies
80	Foreign R&D centers from a diverse range of sectors
USD 8.3 bn	VC raised in 2019

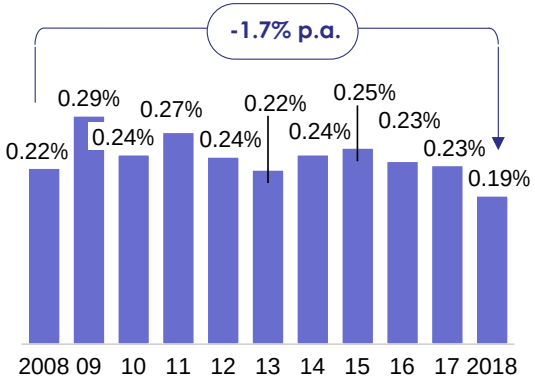
6. Government should play a central role in financing technology innovation and idea-stage ventures

ARMENIA 2021-2041 ideas in action

R&D is a promising source of national prosperity…

… yet, Armenia's share of expenditures on R&D has been slowly declining

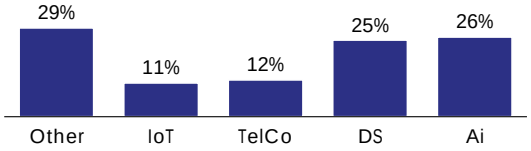
Share of R&D in Armenia GDP, %



Source: IFS, World Bank

Existing government financing options for R&D start-ups

	Start-up grants	**Grant size**, USD thou
1.	"From idea to business" – support of development and commercialization of breakthrough technologies	5
2.	Grants for tech companies with previous investments	57
3.	Grants for tech/IT service companies operating for 2+ years with previous investments	38
4.	Grants for tech/IT product companies operating for 2+ years with previous investments	19



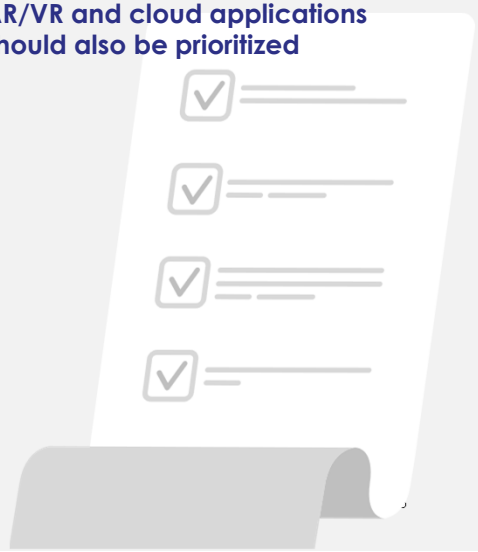
2,000 (total)

R&D grants

5.	Starting Grant for Research Groups and Consolidator Grant for Laboratories with track record working on high-potential projects	30
6.	Advanced Research Grant Program for ambitious and ground-breaking research projects aimed at training scientific personnel.	60

Key considerations

- While funding options are sufficient for start-ups in the seed and later stages, there is a definite **scarcity of early (research and idea) stage funding**, in which government normally plays a central role
- The current funding structure is **in line with the priority sectors** for Armenia's development (AI, Data Science, IoT and Robotics), but **AR/VR and cloud applications should also be prioritized**



7. Foreign direct investment can act as a major source of growth for the IT industry and the economy as a whole (Ireland IDA example)

ARMENIA 2021-2041 ideas in action

What does it incentivize?

Primary objectives are to

- **Attract**, assist and embed **investors**
- **Encourage investment** in Ireland by foreign multi-national corporations
- **Create employment** with economic and social benefits for Irish people

Focus on **advanced manufacturing** or **office-based** activities which depend on high-skill processes or activities e.g.,

- ICT
- Bio Technology
- Knowledge-based industries

Who does it incentivize?

Incentives **focus on attracting FDI**

- Domestic Direct Investments (DDI) incentives through Enterprise Ireland

Promotes FDI through any means (greenfield and brownfield)

Mainly targets large MNCs

Examples include:

Google, Microsoft, Allergan, accenture, ANALOG DEVICES, Boston Scientific (Advancing science for life™), DELL, CREGANNA MEDICAL is part of TE connectivity

How does it incentivize?

Mixture of financial incentives and services through IDA

Tax

- **12.5% corporate tax rate**, the lowest in Europe
- **Effective 0% tax rate on foreign dividends**
- **25% R&D tax credit**
- **Holding company** regime

IDA

- **Centralized** organization leading FDI efforts and client relationship managers help **end-to-end**
- **Signpost** to other organizations if need be e.g., national/local government or recruitment agencies
- Impact and performance **evaluation of companies is done through the IDA**
- Includes **other funding programs and incentives** e.g., training, and business asset grants and mentor and marketing programs
- Success is measured by the **impact on the Irish economy of FDI** and IDA supported companies

SOURCE: IDA website; Press search

7. International public incubator – case study: IDA supports overseas companies in relocating operations to Ireland and the digital hub

Background

The Industrial Development Authority (IDA) is Ireland's inward investment promotion agency

- Autonomous statutory agency set up under the Industrial Development Acts 1986 –2014
- Operates under the sponsorship of the Minister for Jobs, Enterprise and Innovation

IDA Ireland **provides consultancy and support services free of charge to potential investors**

- Works across industry sectors, incl. financial services, bio-pharmaceuticals, medtech, engineering and technology
- Develops ambitious targets to boost foreign direct investment in Ireland as part of its new strategy "Winning: FDI 2015–2019"

IDA activities

Partners with overseas companies to help firms achieve a successful set-up and to expand their operations in Ireland

Offers a range of services to companies considering investing in Ireland, such as

- **Property solutions and development programs:** offers grants and assists with property solutions
- **Access to talent:** ensures permit and visa requirements
- **Site selection services:** collaborates with companies to quickly establish and develop clients' operations
- **After-care support:** offers assistance with key stakeholder engagement, incl. utility providers and local and planning authorities

Offers dedicated talent training and manufacturing development through

- **National Institute for Bioprocessing and Training (NIBRT)** that provides training and research solutions to support the bioprocessing industry
- **Technology centre ARCH1** which aims to provide access to clinician, academic and patient infrastructure for connected health research in Ireland

Objectives and impact

9 of the top 10 pharmaceutical companies in the world, as well as **13 of the top 15 medtech companies**

Highest number of medtech employees per capita of any European country

Recent examples of FDI wins through IDA Ireland

- **Regeneron** invested USD 650 mln in a state-of-the art biopharmaceutical production facility within an 11.88 hectare site in Limerick, with plans to create up to 500 jobs
- **Alexion** invested €75 mln in 2 locations, which will employ up to 300 people
- **Jazz Pharmaceuticals** constructed a €50m, 5,100m2 manufacturing and development facility in Athlone and expects to employ up to 50 people within 3 years

Stated reasons from life science companies for investing in Ireland

- Open economy and developed infrastructure
- Access to talent and low labor costs compared to a number of EU countries
- Attractive tax regime (e.g., corporate tax rate of 12.5%)

In the pipeline

- **GE** €150m in a new biopharmaceutical manufacturing campus on IDA Ireland's strategic site in Cork, creating 500 new jobs
- The 44 hectare IDA-owned land bank in Dundalk has been selected as the location for the establishment of a world-class Science and Technology Park

NIBRT trains up to 1,500 bioprocessing professionals annually to help support the life sciences industry

1 Applied Research for Connected Health

Source : IDA Ireland website; press search

7. Ireland's IDA is a government agency with an exclusive focus on attracting and assisting foreign investors

Mandate

Focus exclusively on the promotion and development of high-quality **foreign direct investment** (FDI) in Ireland by;

- **Positioning Ireland as a favorable environment to invest in**
- **Marketing** the Shannon Free Zone
- **Identify** and build long-term relationships with **targeted firms**
- **Opportunity driven targeting**

Organizational structure

- Organization structured both vertically and regionally
- Dedicated teams targeting potential investors in selected sub/sectors & markets
- **16 international offices** (across U.S., Europe, Asia, and Australia)

Governance

- Autonomous state-sponsored body

Services

- Acts as a **strategic partner**, provides **consultancy** and **support** services
- Provides information on tax, skills, education and research programs, labor law, investment opportunities, operating costs, infrastructure, support services, etc.
- **Introduce potential investors to local industry groups, peer companies,** government and service providers in Ireland
- Facilitate **grants & funding**
- **Lobby** other government organizations **on policies**
- **After-care assistance** to existing investors

ARMENIA 2021-2041 ideas in action

Success track record

#1 In adaptability and flexibility of people in IMD World Competitiveness yearbook (2013)

#1 Best country to invest in in Western Europe (2013)

#1 Best country in Europe in which to do business Forbes (2011)

#1 Most attractive business location in the world out of 82 countries in the Business Environment Ranking of the Economist Intelligence Unit (2008–2012)

NON-EXHAUSTIVE

Five strategic moves in high tech for Armenia to consider

		Selected countries with Best Practices
Prioritized initiatives	 **Develop Advanced Analytics/Artificial Intelligence solutions** to leverage existing knowledge and unlock new capabilities	  
	 **Shift away from low-cost outsourcing to high value-added services/products** to improve labor productivity and increase overall value generation	  
	 **Increase government spend on R&D** to meet domestic needs (including agriculture and security) and expand revenue streams	  
Sector-specific enablers	 **Invest in strong STEM and CS education programs** (e.g., teacher training) to nurture world-class talent	   
	 **Attract expats** through incentives & legislation