3-year report • 2017-2020

en route to innovative armenia...

FAST DISCOVERING THE FUTURE

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Dear Reader,

With this 3-year report, I warmly invite you to get to know the Foundation for Armenian Science and Technology (FAST). I invite you to share in our mission and vision, and to understand better our approach to science, technology and innovation, as well as our organization's current and projected impacts. Crucially, I urge you to explore our potential relevance to you and your own goals, and your ability to shape us and ours.

Technology is the key to future prosperity. Now – and more so in years to come – science and technology-driven innovation will be determinative of economic wealth, national security and international status. It impacts all aspects of governance, economy and society, rendering it a policy area of monumental strategic significance. Going forward, some nations will be the creators of technology, others its dependent receivers. It is the former who will drive the international agenda and set the course for generations to come. We believe that Armenia has a chance to join this cohort.

Armenia faces multiple systemic obstacles to achieving innovative greatness. At FAST we look those obstacles squarely in the eye and reconceptualize them as workable opportunities. Indeed, we understand Armenia not just as a geographic territory, but rather a consciousness that is limitless in reach, creativity, ability and resources. Armenia's global network offers enormous human capital with impressive innovative capacity. Moreover, our nation's history is its CV – a resumé from which ambition can be emboldened.

However, in today's competitive global context, such ambition can only be fulfilled with strategic mobilization, collective endeavor and razor-sharp focus. This is the task that FAST has set for itself. 2017 saw FAST launch with a proneering agenda: an Innovative Armenia taking its seat at the table of top 10 global innovator nations by 2041 – its 50th independence anniversary. Our research suggests that this agenda, albeit exceptionally challenging, is achievable. But achieving such greatness is, in the early stages, a quiet and humble task; a task of foundation setting, of seed sowing and tending. Above all, achieving such greatness is predicated on the fostering of mutual collaboration among those in the relevant fields. It is only when players in the political, administrative, scientific and commercial realms pull in the same direction in their respective ways that the kinds of enhanced outputs that trigger transformative change and inspire substantial investments can be achieved.

The world is a limitless sea of possibility – an ocean therefore of opportunities available to Armenians looking for their own share of global prosperity. At FAST we believe that everyone should have an opportunity to innovate, and that innovation is the vehicle for human fortune. Indeed, a move toward a more innovative future not only benefits science and innovation in Armenia, it also serves as a catalyst for overall economic growth and development in the country, offering education and employment, opportunities for emerging markets and solutions to contemporary problems both at home and abroad. As a common cause, the potential depth of this impact cannot be understated.

I sign off therefore by inviting you once again to explore your role in the Armenian consciousness – a consciousness that, once collaboratively mobilized, will unleash our nation's full potential as a leading tech innovator globally.

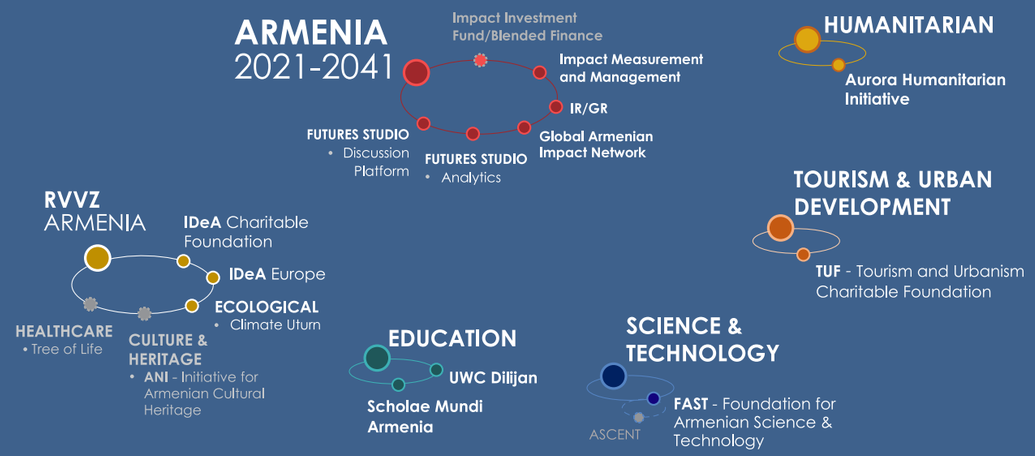
Armen Orujyan

Founding CEO, FAST

ARMENIA 2041 VISION

FAST is a key player within a wider ecosystem of initiatives calibrated to reimagine the future of Armenia. This "Armenian Ecosystem", as depicted below, is composed of a wide array of initiatives and institutions seeking to advance prosperity, humanity and community for Armenia and its people. It spans tourism, finance, science and technology, agriculture and environment, education, healthcare, urban planning and cultural heritage, among other sectors. Its hallmark is a fervent belief in the tremendous capacity and talent of the Armenian people and the country's diaspora, as well as a collaborative spirit to securing the country's advancement. This ecosystem envisions an Armenia that not only celebrates and shares its rich history and culture with the world, but simultaneously takes its place on the global stage as a modern, dynamic and forward-looking nation.

Conceived in 2002 by FAST co-founders, among others, this ecosystem has actively advanced an alternative model for achieving sustainable development in Armenia by stimulating private sector investment alongside traditional philanthropic sources. This approach not only aims at achieving a form of national development that is self-sustaining long-term, but, in doing so, advancing the country's developmental resilience. It ultimately strives to see Armenia and its people not just develop, but thrive by 2041. This aspiration has inspired 600 million USD of investment into Armenia over the last 2 decades.



INTRODUCTION

The Foundation for Armenian Science and Technology was established from an aspiration for Armenia's future that saw a clear role for an organization able to help stimulate and channel the country's scientific and entrepreneurial realms in pursuit of an ambitious development agenda. In 2017, FAST launched with a mission to foster and accelerate the advancement of Armenian science and innovation at home and abroad. Our vision is **Armenia's transformation into a top 10 global innovator nation** and a **top 5 Data Science and Artificial Intelligence innovator** by 2041.

The last 3 years have seen our organization apply itself to that ambitious goal with conviction. 2017 and 2018 were consumed by **vigorous planning and preparation**, including consultation, research and analysis. Aware of the time needed to nurture certain components of a generative ecosystem, and keen to progress Armenia's transition as quickly as possible, 2018 saw us launch some crucial programs aimed at **sowing the seeds** of scientific research and innovation: our Fellowship program, Advanced Solutions Center (ASCENT), the Global Innovation Forum (GIF) and our Science and Technology Angels Network (STAN) already began to take their first exploratory steps.

The launch of FAST's strategic outlook, also in 2018, provided not only the evidentiary basis for FAST's projections for Armenia's **technological leapfrogging** potential, but offered a comprehensive toolkit of interventions designed to set the trajectory for Innovative Armenia 2041. Its official implementation swiftly commenced.

In line with FAST's strategic plan, this 3-year report provides some further insight into our work so far. It outlines the **systems approach** we have adopted to advancing our mission and our grounds for doing so. It also highlights the value already generated through joint ventures with our vital and valued partners. Indeed, ensuring that all stakeholders understand our organization's history and rationale - what we stand for, act upon, strive towards and why - is central to our mission. It is only in this way that further hereto unexplored collaborations can be fostered, synergies revealed and innumerable potentials realized.

Convinced of the need for **transparency around our processes**, this report aims to shed light on how we are seeking to lay a deep and solid foundation for Armenia's propulsion into the realm of top innovators. It details some of the challenges we must overcome and impacts so far experienced from our first years of program implementation.

While these three years of programming, and the five that follow, will provide the bedrock for Armenia's launch as a global innovation leader, their true results will take some years to shine. Such temporal lags are the natural by-product of interventions that stimulate change and interaction among the fundamental but often more slow-moving determinants of success. Notably, it is the latter that will render any such success large-scale and sustainable.

At FAST we approach our mission not merely with blue sky enthusiasm, but pragmatic realism. If stakeholders' expectations are similarly aligned, we can ensure that our efforts are well coordinated. Indeed, the task at hand is highly ambitious. **It is only through sustained collaboration and coordination that an Innovative Armenia can be achieved** by 2041. In presenting to you FAST's work from June 2017 to December 2020, we hope this report can help to augment further such collaboration and coordination to that end.

SETTING THE TRAJECTORY

CHAPTER IN BRIEF

- FAST's vision for Armenia's future enjoys the benefit of precedent in the **experiences of other nations** and Armenia's own **former status** as a leading scientific and technological hub during Soviet times.

- Both the experiences of other countries and the prevailing conditions in Armenia have been **intensively studied** by FAST in developing and implementing its interventions.

- Armenia ranks 61st among 131 countries on the Global Innovation Index 2020, with notable comparative deficits in its human capital and research components. It nevertheless performs above its expected level of development, rendering it an **Innovation Achiever**.

- FAST uses a systems approach in its programming, conceptualizing Science, Technology and Innovation as an ecosystem founded upon the **3 pillars** of Education, Research and Commercialization.

- FAST's **implementation strategy** focuses on enhancing the intellectual, financial and network capacities of Armenia's innovation ecosystem with a view to establishing the foundations for accelerated growth around 2025-2030. Its first years have required uncovering and engaging on essential prerequisites for the launch of larger-scale programs. This has made for highly iterative, fluid and **dynamic programming** as the seeds for larger later programs are sown.

» THE VISION: INNOVATIVE ARMENIA 2041

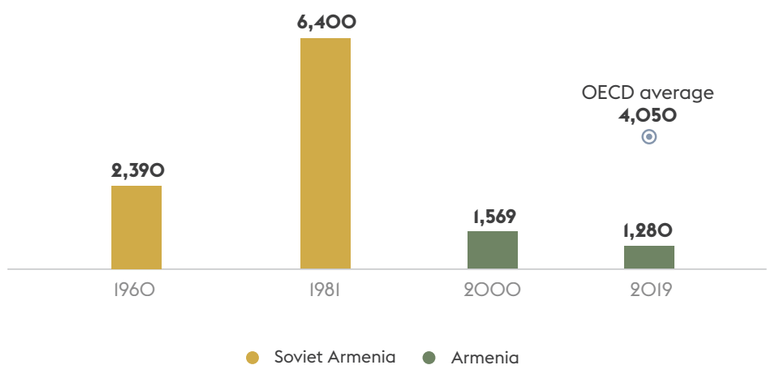
FAST seeks to contribute to Armenia's realization of a dynamic future in the international arena of science and technology. FAST's own vision of what that looks like encompasses various facets.

By 2041 we strive to see thousands of academics drawn to globally competitive and technologically advanced Armenian educational institutions to access pioneering infrastructure, cutting-edge STEM curricula and real-time knowledge synthesis. We envisage highly skilled STEM and business graduates entering a thriving local job market with numerous entry points and exciting career options in diverse fields of science, technology and innovation (STI). Here, a flourishing Armenian research community would be attracting the best international talent and resources with solid local and international collaborations that generate trail-blazing scientific discoveries and technological innovations. We aim for a prolifically fertile and profitable venture building environment feeding a diversified and sophisticated Armenian high-tech and deeptech industry that puts the country on the global map as a hub for technology exports. Through all of this, we envision a future where Armenia is a global driver of human progress in offering revolutionary science-backed solutions to challenges faced both at home and beyond.

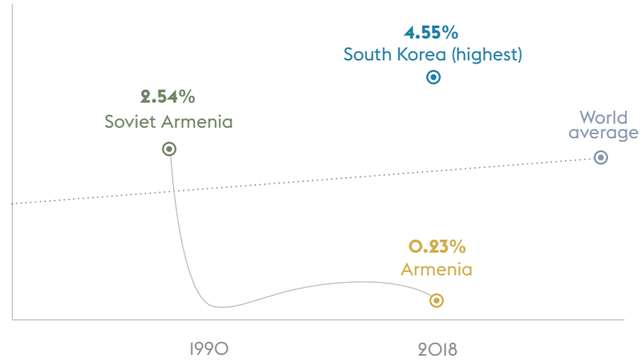
Today's Armenia is taking its first tentative steps towards this future – a future that with enduring commitment and collaboration lies within the country's grasp. This is a conviction founded not merely in optimism, but based on precedent. Other countries of comparable STI ranking have already made similarly ambitious leaps. Such precedents in "technological leapfrogging", as it is called, are instructive for Armenia.

More significantly, however, is the fact that in the field of science and technology, Armenia itself has done it before. It was among the vanguard of the world's discovery of digitalization (one of the first Soviet computer systems was designed here in 1959). The production of strategic microelectronic equipment used by the Soviet defense industry was also formerly Armenia's preserve. KPMG's 2017 reporting highlights that the country was once responsible for 30% of the Soviet Union's defense electronics R&D and was its main hub for software development, industrial computing, electronics and production of semiconductors. Indeed, among Soviet republics, Armenia ranked second only to Russia for its number of active researchers and scientists per million population. As one of the most vibrant scientific communities in the later years of the Soviet Union, the country was formerly home to 22,000 researchers working in 130 scientific institutions. It was thus once already a top technology hub for the Soviet bloc – a "Soviet Silicon Valley", as some have suggested. This status was no accident – it was something influential, talented and driven Armenians worked hard together to achieve.

Graphic 1.1. Armenia as a Science & Technology Hub then and now: number of researchers per million population



Graphic 1.2. Armenia as a Science & Technology Hub then and now: R&D expenditure as % of GDP



While natural disaster and social and political upheaval have since obscured this success, ripples of Armenia's legacy remain observable today: the country boasts high-level representation among the Boston Biotech Club, at giants such as Pfizer and Flagship Pioneering, as well as with leading tech institutes such as Harvard University and Massachusetts Institute of Technology. Armenians are among the C-suite executives or founders of top companies like Reddit and Genpact, and the country has strong representation within the Silicon Valley community, including among the first Unicorn founders.

In short, the concept of an Innovative Armenia is not new. It has, in fact, inadvertently become one of our country's greatest exports. Armenia's past achievements provide a natural baseline in the living memory of its scientific community, and the innovative Armenian mindset and consciousness offer a vast reserve of possibility. This suggests that, with the right stimulus, Armenia has the potential to rebuild its profile as an international science and tech hub. Not only can it reverse its current trajectory on STI, but it could positively thrive, bringing science and technology innovation home once again. Whether it is successful in doing so will be a matter of resolve: as other countries likewise seek to claw their way up the innovation charts, Armenia will have little time to stand still.

» THE BASELINE: ARMENIAN SCIENCE, TECHNOLOGY AND INNOVATION TODAY

Achieving greatness tomorrow requires having one's feet firmly planted in the realities of today. To set the trajectory for Innovative Armenia 2041, FAST has put much effort into objectively assessing the country's current STI landscape. This has involved multiple baseline (and ongoing) assessments of STI in Armenia and beyond, as well as analyses of how other countries once comparative with Armenia have themselves achieved "technological leapfrogging".

While once a major technological and scientific contender, Armenia has seen notable regression in the conditions that made its past achievements possible. The Soviet Union's collapse and a protracted Artsakh (Nagorno-Karabakh) conflict in the late 1980s/early 1990s saw a downturn in both high-tech market opportunities and institutional support, including declines in R&D expenditure and financial inflows. These factors in turn triggered an exodus of scientific talent and a major contraction in Armenian research. In the meantime, competitor nations have successfully advanced their own STI ambitions, further driving Armenia down global innovation rankings.

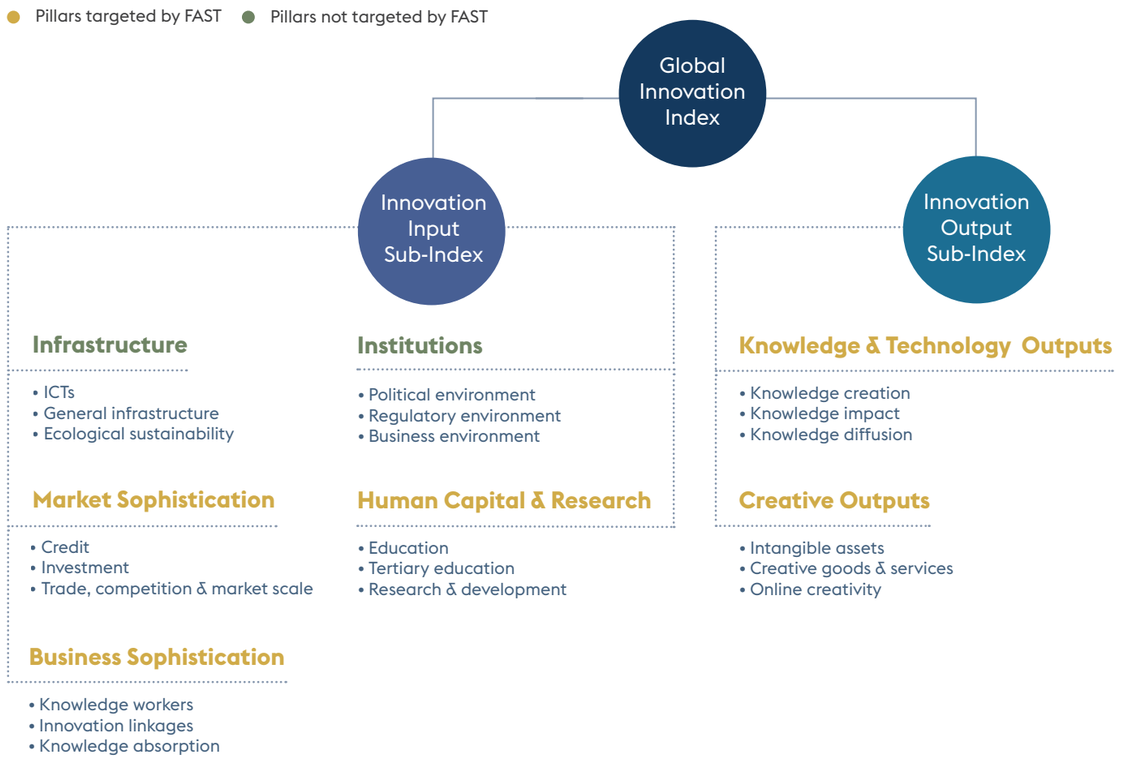
To gauge Armenia's current and future STI placement, FAST refers to the Global Innovation Index (GII) – an internationally reputed innovation ranking published annually by the World Intellectual Property Organization.

WHAT IS THE GLOBAL INNOVATION INDEX AND WHY USE IT ?

The Global Innovation Index began in 2007 and is an annual ranking of countries by their capacity for, and success in, innovation. It is framed around two sub-indices – Innovation Input and Innovation Output. These two indices are designed to capture both those elements of the national economy enabling innovative activity and actual evidence of innovative output through seven input/output pillars.

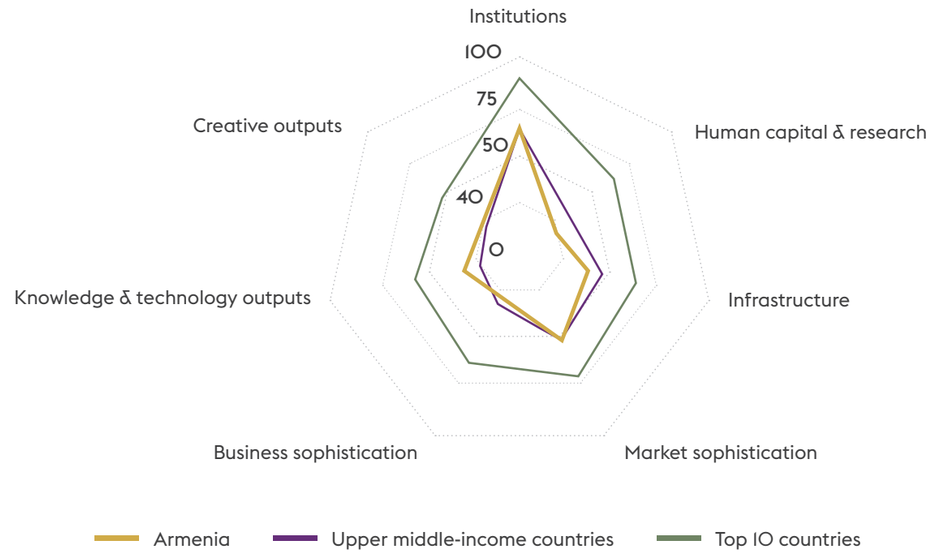
The GII is the only international index to rank countries from the perspective of innovation. As such, it offers a unique and useful tool for tailoring interventions to promote output growth, improved productivity and job growth, as well as detailed metrics that can be used to measure progress comparatively.

Graphic 1.3. The Global Innovation Index framework



Using 80 indicators, the GII captures the various characteristics of innovative nations, including the quality of their institutions, human capital and research, infrastructure and market and business sophistication. Armenia currently ranks 61st among 131 countries in the GII 2020.

Graphic 1.4. Armenia's scores on the seven GII 2020 pillars compared to other countries



Nourishing Armenia's innovation ecosystem thus requires improving performance on indicators currently exhibiting weakness, while optimizing – or at least not hindering – the country's positive attributes. These weaknesses and attributes are briefly outlined in what follows.

ARMENIA'S INNOVATION DEFICITS

Armenia's scores under the 7 GII pillars (see graphic 1.4.) highlight particular deficits in the country's human capital and research spheres. These spheres are closely tied to two key indicators of innovation success - namely, national education and R&D expenditure.

Of many variables influencing innovation, national spending on education and R&D have a defining impact. The World Bank's 20-year data from the World Development Index highlights a clear correlation between government education spending and GDP, with data across a large sample of countries suggesting that for every government dollar spent on education, GDP grows by around 20 USD on average. Likewise, R&D expenditure is closely correlated with all other major STI indicators, acting as a good predictor of a country's innovativeness. Here, studies indicate that a 1% increase in the proportion of GDP spent on R&D stimulates around 2.2% GDP growth.

GOVERNMENT EXPENDITURE ON EDUCATION: A KEY INNOVATION DRIVER

Armenia spends only 2.7% of GDP on education – of this, only 13% on higher education. OECD (Organisation for Economic Cooperation and Development) countries, by contrast, spend nearly twice as much (an average 5% of GDP) on education, with 22.6% of that outlay going to higher learning.

Low investment in education creates growth constraints for Armenia's professional human capital and thereby risks inhibiting existing innovative development. The expansion of Armenia's Information and Communication Technology (ICT) sector is illustrative in this regard. Armenian ICT has seen considerable growth since the 2000s and particularly in the last 10 years. While ICT graduate numbers rose from 1,692 to 2,239 in the 4 years up to 2019, the number of new jobs created in the industry that year topped over 4,200. Thus, maintaining a professional workforce is a key innovation challenge even in ICT – a sector experiencing graduate growth.

The challenge is even more acute for Armenia's wider STEM sector: recent data highlights that Armenian STEM personnel numbers suffer a notable imbalance compared to ICT, which makes up a far larger segment of Armenia's professional workforce. As well as stifling non-ICT areas of STI growth, the low number of STEM professionals in Armenia risks further compounding pipeline challenges for the development of the IT sector itself. This is due to the fact that increased integration of STEM into IT through advances in high-tech engineering and artificial intelligence is driving higher levels of co-dependency between the two sectors when it comes to innovation. However, the number of STEM professionals being generated in Armenia appears to be, if anything, in decline: 2018 saw a 33% drop in Armenia's overall STEM student numbers compared to 2010. Meanwhile, STEM PhD student numbers have likewise seen an annual decline of 25-28%, with a further 15-17% decline in students graduating. Long-term, the impact of this regressive trend on innovative human capital risks being further exacerbated by the fact that, according to the Armenian Science Committee, about 40% of all Armenian researchers were over retirement age in 2018.

These factors highlight significant human capital pipeline challenges facing Armenian innovation both now and in the years to come. They demonstrate the need not just to stimulate the cultivation of a new generation of STEM professionals and researchers, but to ensure accelerated growth to close the increasing gap between STEM and IT in the country. Indeed, while demand for IT professionals in Armenia currently outstrips supply, the present scarcity of employment opportunities and low wages in the Armenian STEM sector adds little incentive to would-be student entrants. Moreover, both companies and students highlight a longstanding substantive gap between industry needs and university education, inhibiting the production of a work-ready STEM-focused labor force.

NATIONAL R&D EXPENDITURE: A CORE MEASURE OF INNOVATIVENESS

Armenia's financial allocation to research and development again indicates significant and systemic challenges for advancing fundamental and applied sciences in the country. Since 2009, gross domestic expenditure on R&D has been 0.23% of GDP on average – of which 76% is spent on engineering & technology and natural sciences. The OECD average is 2.4%. While the above R&D spending figure excludes private corporate R&D expenditure, which is not properly collated in Armenia, estimates for the overall total remain modest.

Armenia's own high-tech sector, which is focused predominantly on IT, overwhelmingly outsources R&D. While some Armenian companies are gradually starting to foster their own R&D activities, the intensity of such activities is low. Science-backed or deeptech startups remain few and rather an exception than in any way a result of the ecosystem's efficiency. Moreover, the country still lacks mature science-intensive venture builders to accelerate the process of startup creation and provide the stimulus needed to foster innovative indigenous companies capable of achieving higher valuation than their outsource-oriented counterparts. Such venture builder-backed companies have a 60% likelihood of providing for returns compared to just a 5-20% likelihood among venture capital-backed startups.

OTHER STRUCTURAL CHALLENGES

While it is clear that improved education and R&D spending are currently key to addressing Armenia's near and long-term innovation deficits, other structural inhibitors of scientific and technological innovation include:

- The absence of Armenian universities among the top 1,000 universities globally;
- Significant disparities between local research institute outputs despite similar levels of per capita funding;
- Only a small cluster of Armenian scientists publishing, producing competitive research and engaging in international collaborative networks;
- A lack of state-of-the-art research infrastructure and lab facilities;
- Limited opportunities for networking and collaboration with world-class researchers and research centers.

ARMENIA'S EMERGENT INNOVATION POTENTIALS

Armenia's overall international ranking for innovation may be middling, and in certain sectors scoring poorly, but WIPO nevertheless classifies the country as an "Innovation Achiever". This is due to the fact that it performs above its expected level of development.

The last decade has seen signs of Armenia's growth potential. Here, the green shoots of innovation are manifest in a number of local companies securing reasonable investments to help drive innovation in their respective fields, including PicsArt, Krisp, Teamable and SuperAnnotate AI, among others. There has also been a growing number of accelerators, angel investors and venture capitalists establishing a presence in Armenia over the last 5 years.

Indeed, the ICT sector in particular has seen considerable growth. Comprising 900 companies in 2019, that year saw an average of 30% annual growth rate in the number of companies – up from the 25.6% annual average of 2010 to 2018. Likewise, Armenia's high-tech sector turnover has also risen over that period from 144 million USD in 2016 to 320 million USD in 2019.

Favorable conditions for nurturing Armenia's potential have also started to emerge on the structural level. This has seen the passing of beneficial legislation that includes tax privileges for Armenian IT and export sectors, and the establishment of free economic zones, customs-free trade within the Eurasian Economic Union, and Generalized System of Preferences (GSP) and GSP+ regimes with a number of developed countries. Armenia's eligibility for the European Union's HORIZON 2020 and COSME programs (as well as its mobility and other schemes) likewise provide welcome growth stimulus. Additionally, the recently established Ministry of High-Tech Industry is offering grants and incubation and acceleration programs for startups at their different stages of development. Meanwhile, in the education sector, progressive Armenian initiatives, like the TUMO Centre for Creative Technologies (ranked number one among the World's Best Innovative Schools), COAF Stmart Center and the Armath Engineering Laboratories educational program, are helping to cultivate Armenian youngsters equipped with the skills and knowledge to succeed in the modern digital era from an early age (10 to 18).

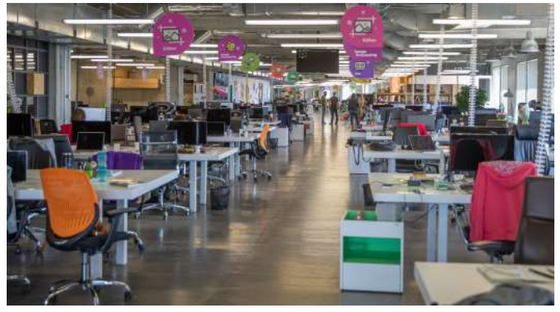
COAF Smart Center is a 5 million USD development initiative for community and individual growth with a 50 acre campus serving over 1,700 beneficiaries from 27 closest communities in Lori.

TUMO Center for Creative Technologies is a free after-school program benefiting around 20,000 teenagers through its 6 centers in Armenia and 5 international centers abroad.


TUMO Yerevan


TUMO Gyumri

42 Yerevan is a tuition-free programming school designed to train the coders of the future. 42 Yerevan is a member of a global network of France-based programming schools with locations in more than 20 cities around the world.



PicsArt is the world's largest creative platform, and combines creative tools, unlimited content and an interest-based community of 150 million monthly creators and over one billion installs.

Synergy International Systems is a global software company that has 200+ multi-lingual employees worldwide and provides products and services to organizations in more than 70 countries since founding nearly 20 years ago.

THE APPROACH: SYSTEMS THINKING

While Innovative Armenia 2041 is certainly achievable, Armenia's current status highlights that the task at hand is not to be underestimated. It is complex and challenging, and requires a comprehensive approach capable of encompassing the many variables that can affect a successful outcome. As such, FAST takes a systems approach to its strategy and programming. This approach is the lens through which we design our interventions and is central to how we structure, implement and assess our programs.

WHAT IS A SYSTEMS APPROACH AND WHY USE IT ?

A systems approach identifies elements and sub-elements comprising a system, and how these function and interact with each other to shape overall system function and outcomes. It is a particularly useful analytical tool for resource managers and policy developers in helping to identify leverage points for intervention, and indicators to monitor and forecast outcomes in complex, adaptive and cross sectoral spaces.

This can help to foster positive trajectories of growth even in more complex contexts and also provides a reflexive framework for ensuring sustainable system change.

UNDERSTANDING SCIENCE, TECHNOLOGY AND INNOVATION AS AN ECOSYSTEM

A systems approach allows us to conceptualize STI in Armenia as a dynamic ecosystem that rests on 3 core pillars: Education, Research and Commercialization. These 3 pillars determine the strength of STI in Armenia. They drive the development trajectory of STI to the extent that it is preserved by education, expanded by research and applied through commercialization.

FAST's systems lens enables us to take a carefully balanced approach to enhancing STI through these pillars. This is essential as, for example, investing in STEM talent alone simply generates a "brain drain" if there are no indigenous companies to absorb and commercialize educational and research outputs. Here, interventions to stimulate technological development and company creation are an important corollary to fully realizing the benefits of investments in education and research.

Graphic 1.5. Conceptualizing Armenian Science, Technology and Innovation as an ecosystem

As alluded to above, the strength of STI's 3 foundational pillars and the outcome of interactions between them are highly dependent on their underlying resource capacities. It is through careful interventions targeting these resource capacities – namely, the **intellectual, financial** and **network capacities** of each pillar – that an interactive dynamic can be stimulated to drive rapid and sustainable STI growth. These three vital capacities reinforce each other's impact both within and among the three pillars. As such, it is these capacities that FAST's programming primarily seeks to reinforce.

In short, FAST offers a degree of system level intent to Armenia's innovation growth in coordinating deliberate interventions to bolster the key determinants of Armenian science, technology and innovation - namely, education, research and commercialization - by enhancing intellectual, financial and network capacities in these sectors.

Graphic 1.6. Conceptualizing the role of resource capacities on Armenian STI pillars

In viewing STI in this way it is important to recognize that the pillars determining Armenia's innovation development do not operate in a vacuum. Other influencing factors that function in accordance with their own system logics and processes can likewise have a notable impact on each pillar and thus overall STI growth. For example, factors such as regulations, transportation, energy and communications infrastructure provide an important and influential backdrop to how any national endeavor develops. While FAST assesses the impact of some of these external factors on Armenia's STI development, sharing its findings with relevant stakeholders, it does not primarily or directly target these factors in its programming unless they have an explicit and dominant bearing on sectoral advancement.

THE STRATEGY: 2020, 2025 AND BEYOND

Applying its systems approach to the prevailing state of Armenia's STI ecosystem has helped FAST to identify critical leverage points for intervention and to develop a timeline for both what is required and also what can be expected of Armenia's own rise. First launched in 2018 and further refined in 2019, FAST's strategic plan consists of a toolkit of projects and programs, a five-year roadmap and a series of indicators to chart progress up to 2025 and beyond.

FAST's first five years of strategic implementation (2019-2023) lay much of the critical groundwork for STI growth. To that end, our first implementation years have directly targeted intellectual, financial and network capacities with a view to sowing the seeds for larger projects capable of stimulating broader growth. This has seen a focus on interventions such as grants, education and training, science-intensive venture builders, large-scale events for data science and artificial intelligence placement, and strengthening international links to bolster both intellectual and network capacities. That work has been further expanded and built upon into 2020.

Indeed, these early years of FAST's operations have been characterized by high levels of fluidity and dynamism in both our strategy roll out and program development. A variety of different tools and interventions have had to be conceptualized, tested and adapted to the realities with which they have been met. This has meant taking the time to conduct thorough feasibility, cost-benefit and impact assessments, which have ultimately seen initiatives as originally conceived, reshaped or suspended where, for example, certain feasibility or impact pre-requisites were found to be missing. Here, FAST's long-term perspective continuously seeks to lay the ground for more advanced and necessary interventions at a later stage. On going reflection on our progress and the obstacles we have encountered have all fed into the shaping of our plans for the next five years of program implementation (for more see "*The Course Ahead*").

FAST seeks to generate growth broadly across Armenia's entire STI ecosystem. However, experience from other leapfroggers shows the crucial benefits of concentrating efforts on a few specialized areas. Armenia's history, its burgeoning ICT sector and anticipation of the fourth industrial revolution highlight artificial intelligence and data science as the most apt such specialisms for Armenia. Using the country's ICT expansion as a platform, our strategic plan therefore concentrates particular attention on this core focus area.

While FAST's efforts to augment the foundations of Armenian STI have been, and continue to be, varied and numerous, their effects cannot be expected to materialize in truly rapid innovation growth until around 2025 to 2030: students must graduate, projects must complete, citations must accumulate, incubated startups must reach fruition. It is only once the outputs of Armenia's education, research and commercialization pillars have been enhanced and synergized, that optimal return on investment capital can be realized and further investment/reinvestment generated. At that stage greater revenue generation and an attendant expansion in high-tech job opportunities and R&D can be expected to trigger Armenia's own "technological leapfrog".

OUR PEOPLE: WHO IS FAST?

The notion of regenerating Armenia's scientific and technological innovation to reach the country's full potential has drawn prominent professionals from across the globe to FAST's work.

The conviction that Armenia has the chance to shape its own history has united our founders and board members in pooling their efforts and resources to advance this vision. It is also a driving force for our organization's management and wider team – a fact reflected in the passion with which they do their work.

Our founders and other members of our **Board of Trustees** are highly respected figures in the world of academia, science, business and innovation. They are experts, innovators and leaders in such relevant commercial, strategic and policymaking fields as innovation in biotech, high-tech sector development, finance and investment, renewable energy and education. As such, they bring with them a vast experience of developing successful ventures, and leading thriving science-backed organizations and global companies, as well as lecturing at top academic institutions. They have all made distinguished contributions to and impacted on social causes, supporting social ventures and Armenia-focused initiatives. The last 20 years have seen them and their partners invest in Armenia over 600 million USD in educational development, tourism, urban development, human rights and other critical fields.

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Serial Entrepreneur, Venture Investor
Owner and Chairman, ProfHolod, Armenia

Over the past three years, many important things have happened in Armenia and in the world that have had a direct and significant impact on each of us, as well as the work of the Foundation.

More than three years ago, I took on the role of chairman to FAST's Board of Trustees. I would like to express my gratitude to each of FAST's co-founders, and Board of Trustees and Advisory Board members for their effective cooperation and contribution to the formation of this Foundation throughout this time. I am grateful to Armen Orujyan for taking on the main executive role, organizing and carrying out the productive management of the Foundation's daily activities.

Initially, upon FAST's establishment, we intended to become the central element of Armenia's scientific and technological ecosystem: its main unit and development institution, playing a leading role in the ecosystem's formation – the main beneficiary of which is the state. The government committed to support us and follow our recommendations and advice, including as regards to regulation.

We adopted the FAST strategy: we are building an ecosystem that drives scientific and technological development in Armenia. Thus, we have constantly been building our activities on the premise that we are, in fact, the central element of the scientific and technological ecosystem in the country – an institution of state development.

We have managed to realize a lot during this time: a strong and competent team was created, and widespread recognition achieved among Armenian scientific and academic communities, and tech and venture industrial communities.

Today, the Foundation continues to function successfully, despite the pandemic and economic crisis.

During these three years, we have designed and implemented more than 20 different programs, some of which continue today. I would like to highlight the most important of them:

- ASCENT – a commercial initiative, a unique venture building model, a model of technological entrepreneurship.
- Unit 1991 Education and R&D – a unique program for Armenia created together with the Ministry of Defense.
- ADVANCE STEM Research Grant program – grants to support research as such and researcher teams.
- Global Innovation Forum – a high-class scientific and technical forum in Armenia, which became a landmark attraction event in the country.

These programs need to be continued, and we also need to scale-up the ADVANCE STEM Research grant program and attract external financing into this.

We have managed to earn a strong reputation in the country as a creative organization efficiently and effectively implementing important programs. Some initiatives have become role models. At the same time, with our approach, we have set new standards and levels of quality in the creation and implementation of programs and initiatives.

However, there are also plans that have not yet been realized. Among these, I will single out a few key ones:

- no laboratories have yet been created (one laboratory is planned);
- no scientific centers have yet been built (there have been a number of negotiations on this, but so far, no such work has started);
- not enough funds have been raised for science;
- not enough scientists have been involved in our activities.

On the other hand, three years is a short time, and the first three are critical to the life cycle of any new organization. This period of conception, rapid growth and formation for our organization has been successfully completed. We couldn't – didn't have time to – realize a lot of what we would have liked. Nevertheless, I rate our record so far as having made a good start.

It is important to build our future around more concentrated and focused activity, and clearly define the scope of collaboration with the government in terms of co-creating, implementing and scaling the programs. As such, our main attention should be focused on what follows.

For the development of advanced science in the country to be taken seriously, it is absolutely crucial to create scientific centers and laboratories around promising, breakthrough ideas and directions with the involvement of a top scientist to assemble and educate a team, teach and become the founder of a scientific school. It is possible to create such centers in partnership with an industrial player, with institutional or private long-term financing. Our role in creating scientific centers can be organizational and coordinating, using our network capabilities.

ASCENT, together with its venture fund, should be a key focus, attracting private commercial capital in the development of technologies and the serial creation of high-tech startup companies (deeptech), followed by financing for growth and building of champion companies.

Science and the scientific method of thinking must be popularized.

Our influence and lobbying opportunities must be used to increase state funding of science.

Ruben Vardanyan

Co-Founder, FAST
Social Entrepreneur, Impact Investor and Venture Philanthropist
Founder, RVVZ Foundation, Russia

Armenia had a huge scientific and technological heritage, which was, unfortunately, almost lost over the last 25 years of independence. The April 2016 war showed that our country is in dire need of reviving one of the key areas of its development. In the 21st century, advanced science and innovative technologies are the most important element of any country's success. Reality dictates that we head in this direction as quickly as possible. Three years is, of course, a very short time in which to see any progress in areas like science and technology, where development cycles are much longer than in other fields. But what is being done today is of a high professional standard, which is very encouraging. We see an enormous need for institutions like FAST, not only in Armenia but beyond. I am certain that FAST is on the right path and that it will play a major role in developing Armenia's ecosystem, which Noubar Afeyan, others and myself had outlined within the "Armenia 2020/2041" project launched 20 years ago.

Of course, we face many challenges and complex issues ahead. One of them is to leverage the combined strengths of Armenia and its Diaspora. Our country will only be able to restore its scientific and technological potential in cooperation with the world and by consolidating its own and the world's unique resources. Today, our brainchild is taking its first steps, but I hope that we have laid a good foundation for moving forward. I would like to wish the project team every success and great energy in conquering new peaks.

Noubar Afeyan

Co-Founder, FAST
Founder and CEO, Flagship Pioneering, United States

Education and knowledge acquisition have been foundational elements of Armenian identity and culture for centuries. As today's Armenian Republic emerges from its past, there is a growing, historic thirst to acquire knowledge, in particular about science and technology and to apply it to become a productive and competitive nation. After 20 years of working on development projects in and for Armenia, we founded FAST, to strengthen the country's innovation ecosystem and to connect it to global networks, in particular through Diaspora Armenians working in the relevant fields. In a short time, through its scholarship grants, training programs, startup incubation and acceleration initiatives and several other efforts, FAST has emerged as an important catalyst for progress.

By focusing on artificial intelligence/machine learning, biotechnology and nanotechnology, three important and thriving sectors, FAST has brought world class experts to Armenia to contribute their knowledge and help in developing long-term plans to establish a regional innovation hub there. Moving forward, and based on strengthening collaborations with the Armenian Government and other supporters, FAST envisions growing the community of academic and private sector scientists and technologists in Armenia and forming a development corps committed to a prosperous and a secure future for the state and for the global Armenian nation.

BOARD OF ADVISORS

Our **Board of Advisors** is composed of prominent leaders of the global scientific community, heads of large international organizations and esteemed government representatives, including the President of the Republic of Armenia. With their guidance and support, we are able to steer our programs' course in the right direction and ensure that their valuable expertise is reflected in every step of our activities.

H.E. Armen Sarkissian

Honorary Member, Board of Advisors, FAST
President of the Republic, Armenia

FAST is a path toward the future. In the 21st century, the future is education, science, technologies. In our rapidly changing world, Armenia will not be the only country competing for technologies. There is only one path that will lead us to victory in that competition. We must work hard; we need to consolidate our entire knowledge, know-how, our brilliant minds to compete with the best in the world.

FAST is a unique platform that understands this simple truth. It has played a significant role in paving the way for new technologies and building an ecosystem of technological innovation and scientific progress.

Garabed Antranikian
Chairman, Board of Advisors
Professor, Technical University of Hamburg, Germany

Lord Ara Darzi of Denham
President, British Science Association, United Kingdom

Arayik Harutyunyan
Ex officio member, Board of Advisors
Minister, Ministry of Education, Science, Culture and Sports, Armenia

Yuri Oganessian
Scientific Leader, Flerov Laboratory of Nuclear Reactions, Russia

David Yang
Founder and Chairman, ABBYY, United States

Naira Hovakimyan
Professor, University of Illinois at Urbana-Champaign, United States

Mikhail Pogosyan
Rector, Moscow Aviation Institute, Russia

Serge Tchuruk
Consultant, Former Chariman, Alcatel-Lucent Enterprise, France

Gabrielle Gauthey
Senior Vice President, Total, France

Ron Hovsepian
Executive Partner, Flagship Pioneering, United States

Mary Papazian
President, San Jose State University, United States

Hovhannes Avoyan
Founder and CEO, PicsArt, Armenia

Vardan Sahakyan
Senior Scientist and Head of High Energy Gamma Ray Astrophysics Group, A. I. Alikhanyan National Science Laboratory, Armenia

Garabed Antranikian
Chairman, Board of Advisors, FAST
Professor, Technical University of Hamburg, Germany

Global challenges, including climate change, preserving the ecosystem, supply of resources, energy, health and nutrition are interdependently affecting the lives of future generations. Innovative strategies that are sustainable in life sciences, computer science, machine learning, artificial intelligence and environmental science are essential to mastering these challenges. The transition to a sustainable circular economy requires cutting-edge technologies that ensure economic growth with environmentally responsible action. This transition will only be feasible when the opportunities of digitalization are also exploited. In the last three years, FAST and its team have played a pivotal role in this respect.

By initiating different programs FAST has supported more than 43 young and motivated researchers from Armenia and 21 research projects, stimulating the exchange of ideas and know-how in an open atmosphere. These activities have provided young researchers a forum for debate and discussion, and the opportunity to build a network between groups from various key laboratories from Armenia and abroad. FAST has created a new culture with a high degree of collaboration and openness.

NEXTGEN COUNCIL

In October 2017 FAST has created a **NextGen Council**, which brings together the talent, knowledge and skills of 18 young and motivated scientists and technologists. The Council places a special emphasis on gender (we have 8 women on the Council) and geographical diversity in the selection of its members pool. Council members come from the fields of bioscience, medical sciences, machine learning and quantum engineering, as well as technological, innovation and entrepreneurial fields. The Council's geographical spread, which extends from Armenia to Europe, Asia and America, also ensures that the worldviews and perspectives upon which it can draw are comprehensive and diverse.

Haig Eskandarian
Chairman, NextGen Council
EMBO Advanced Long-Term Fellow,
University of California,
United States

Erik Aznauryan
PhD Candidate, ETH Zurich,
Switzerland

Lilian Grigoryan
Cardiologist, Hospital General
Universitario Gregorio Marañón,
Spain

Karen Keryan
Assistant Professor, Yerevan State
University, Armenia

Armen Derkevorkian
Member of Technical Staff,
Jet Propulsion Laboratory, California
Institute of Technology, United States

Hrant Khachatrian
Director, YerevaNN, Armenia

Liana Yepremyan
Postdoctoral Fellow, University of
Chicago, United States

Astghik Hakobyan
Research Scientist, Institute of
Molecular Biology, National Academy
of Sciences, Armenia

Tigran Shahverdyan
Co-Founder and CTO, Robomart,
United States

Vahe Tshitoyan
Postdoc, Lawrence Berkeley National
Laboratory, United States

Elvira Kinzina
PhD Student, Massachusetts Institute
of Technology, United States

Anahit Hovhannisyan
Postdoc, Institute of Molecular
Biology, National Academy of
Sciences, Armenia

Meghedi Babakhanyan
R&D Scientist Engineer, Stanford
University, United States

Armen Verdian
Co-Founder, GA Partners, France

Ani Nersisyan
Quantum Engineer, Rigetti Computing,
United States

Larisa Adamyan
Quant Analyst, Dyos, Germany

Shahen Melikyan
Chief Legal Officer, Sistema Venture
Capital, Russia

Gevick Safarians
Neural Engineering Graduate Student,
University of California, United States

Erik Aznauryan

First Chairman, NextGen Council
PhD Candidate, Department of Biosystems Science and Engineering, Swiss Federal Institute of Technology - ETH Zürich, Switzerland

FAST has courageously embarked on an ambitious yet incredibly arduous road of re-igniting scientific excellence in Armenia. And what might be more exciting for a young and passionate professional than to take part in a broad and complex initiative dedicated to the development of their motherland and backed up by world-renowned leaders in science and entrepreneurship? The creation of the NextGen Council within FAST was thus a genuine and organic continuation of this desire of young Armenians in science and technology fields to volunteer their time to the empowerment of our nation. Despite the uneven nature of this road, the final goal of creating a more prosperous science-based economy in our country is too attractive to be abandoned, and NextGen continues to support FAST's projects with reinforced dedication.

OUR TEAM

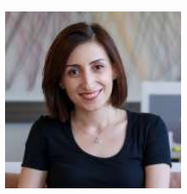
Our **team** of bright young professionals has tremendous enthusiasm and works tirelessly and with the utmost dedication to our organization's mission. While each individual in our team has their own story, we are all united under the same vision of Innovative Armenia 2041.

Andre Serobian
Lead Innovation Analyst

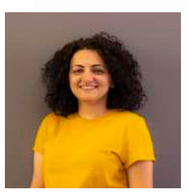
Anna Khachatryan
Innovation Analyst

Haykaz Aramyan
Lead Innovation Analyst

Haikouhi Oroudjian
Communications Lead



Anahit Nersisyan
Communications Officer



Lilit Harutyunyan
Lead Designer

Suzanna Shamakhyan
Vice President/Director of Programs and Partnerships

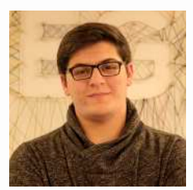
Anush Kostanyan
Program Coordinator

Hasmik Ter-Grigoryan
Partnerships Officer

David Sarkisyan
Vice President/Director of Advanced Research Initiatives

Anna Yeghiazaryan
Senior Research Analyst

Gohar Hovsepyan
Advanced Analytics and Modelling Researcher



Yegor Rapyan
Machine Learning Research Engineer

Veronika Aghajanyan
Program Coordinator

Larisa Avetisyan
Grants Coordinator

Davit Ghazaryan
Senior Research Associate/Data Scientist

Nshan Potikyan
AI Engineer

Ani Khachatryan
Machine Learning Research Engineer

Hovakim Zakaryan
Senior Research Analyst

Vardan Harutyunyan
Research Associate/Data Scientist

Mher Matevosyan
Data Science Expert

Irina Tirosyan
Data Scientist

Harutyun Saakyan
Computational Biologist

Smbat Gevorgyan
Senior Research Associate

Narek Abelyan
Computational Biologist

Marine Khachatryan
Financial Controller

Mariam Aleksanyan
HR Generalist

Angelika Simonyan
Legal Counsel

Susanna Sarajyan
Executive Assistant

Artur Tadevosyan
IT Specialist

Lavrent Sahakyan
Driver

OUR COLLABORATIONS: PARTNERSHIPS AND THE OPPORTUNITIES THEY OFFER

Collaboration is key. Engaging partners and networks to harness coordinated work and joint effort is the backbone to FAST's operational approach. Indeed, the interrelations and collaborations of all stakeholders in the Armenian STI ecosystem are ultimately determinative of that system's success as a whole. Not only do they strengthen STI for the common good, but they simultaneously augment the capacities of the individual stakeholders engaged in such collaboration. This creates opportunities for all involved.

FAST continuously works on establishing long-term partnerships with a wide range of stakeholders from government to academic institutions, from international organizations to private sector representatives, from other foundations and civil society organizations to accelerators and venture capital funds. This has seen us develop a network of about 70 partners in the past three years with whom we have carried out joint programs and set a trajectory for long-term collaboration.

GOVERNMENT PARTNERSHIPS

Our partnerships with the Armenian Government and its various agencies are crucial to achieving STI advancement. Just as government interest and support have been key to FAST's accomplishments to date, our own objectives and programming have proved complementary to the Government's own national and sectoral strategies. This makes FAST a natural partner for the Government of Armenia.

Our government collaborations are particularly aimed at shaping tactical interventions to realize Armenia's technological future through strategic planning, providing research-backed roadmaps, participation in committees and co-creation of programs. We pilot solutions/frameworks that can later be scaled by the Government to meet its targets, using money, expertise, networks and a capacity for experimentation that government typically lacks. This ultimately empowers state institutions to take ownership of programs that prove to be successful – a win-win in offering the Government tried-and-tested solutions and us sustainable programming.

As such, FAST's cooperation with the President's Office, Prime Minister's Office, the Ministry of Education, Science, Culture and Sports (and adjacent Science Committee), the Ministry of High-Tech Industry and the Ministry of Defense, has been of particular strategic importance. Our programs have proven to interest a broader national constituency as our engagements extend to the National Assembly, the Office of the High Commissioner for Diaspora Affairs and the Ministries of Economy, Foreign Affairs and Environment. Our team, represented by our CEO, directors and program leads, is also often invited to sit on various expert advisory bodies adjacent to the Ministries, including 7 committees to date.

Our government partnerships are not restricted to Armenia, however. We have also been developing highly constructive collaborations with governments in regional tech hubs in Africa and Asia, where untapped investment potential, market expansion and mutual development offer reciprocal opportunities for capacity enhancement, networking and business exchange.

To understand the kinds of **opportunities we offer for government partnership and collaboration**, look out for our work on various programs in the later segment, "**Navigating the Tide**":

- Unit 1991's Education and R&D
- Competitive Lab Infrastructure
- Innovation District and Adaptive Innovation Campus
- Neruzh Diaspora Startup Program
- Global Innovation Forum
- Fellowship
- Global Partnerships and Collaborations

We see future Armenia as a modern, technologically advanced and innovative country. To reach that ambitious goal we aim to create the necessary preconditions so that the country is ready to absorb global knowledge, the economy is capable of an upwards technological shift, and there is enough capacity to produce and export high-tech products and services.

In a very short period of time, FAST has become the Government's invaluable partner in this quest and one of the forces shaping the scientific and technological ecosystem of Armenia. I am convinced that through close cooperation with FAST and our other partners we will prepare Armenia for a technological leapfrog from a developing nation to a developed one.

Tigran Avinyan
Deputy Prime Minister, Armenia

FAST is making a real difference in Armenia, and does it with a long-term vision. Innovation for (with) impact entails partnerships fit for a long journey. Among other areas, UNDP is happy to partner with FAST on our journey of impact acceleration through ImpactAIM Venture Accelerator. A partnership that impacts people's lives in a profound way while putting science and tech/innovation together with human development at the core.

Dmitry Mariyasin
Resident Representative, United Nations Development Programme, Armenia

COLLABORATION WITH INSTITUTIONAL DONORS AND INVESTORS

FAST's global outlook and strategic interventions to drive home wider national development gains through an STI lens offer innumerable opportunities for alignment with institutional donors and investors, particularly development-focused entities. These synergies are enhanced by our shared targets under the Global Innovation Index and the UN's Sustainable Development Goals, boosting the efficiency and scale-up of initiatives through the alignment of mutual effort.

Our work with institutional donors and investors includes financial support, as well as joint project design and implementation. Strategic and policy development exchange is also a key feature. Initiatives like the AgriTech Accelerator, on which we are partnered with the UNDP and the Armenian National Agrarian University, highlight the access we can offer institutional partners to local and international networks. They also showcase our deep understanding of the actors, dynamics and systems needed to generate successful development outcomes on the ground in Armenia. In this regard, FAST has sought to contribute meaningfully to development perspectives through entities like the World Bank and UNCTAD – both have drawn on FAST's in-depth knowledge of Armenia's innovation ecosystem in helping to calibrate efforts to harness Armenia's development potentials more broadly.

FAST collaboratively scales tried and tested interventions to drive benefits through Armenia's institutional architecture, namely, existing ecosystem players like local entrepreneurs, business leaders, academics, government agencies and the Armenian diaspora. This embedded approach helps both institutional donors and impact investors to optimize the use of their capital for good by ensuring that project outcomes become self-sustaining in the long run.

Indeed, FAST's commitment to Armenia's advancement is itself institutional. With a 2041 vision, FAST is in it for the long haul. This sees us work tirelessly to maintain the continuity and follow-up of our programs beyond the social, economic and political upheavals of the day to meet our broader aims. Moreover, our own commitment means that institutional investments and contributions are generally matched by resource and network inputs from our side – FAST contributes its own money, knowledge and labor to ensuring that development outcomes are realized. We too are impact investors, and as such are careful and conscientious about where we put both our resources and those of our partners.

To understand the kinds of **opportunities we offer for institutional collaboration and investment**, look out for our work on various programs in the later segment, "**Navigating the Tide**":

- Innovation District and Adaptive Innovation Campus
- Global Innovation Forum
- Competitive Lab Infrastructure
- ADVANCE STEM Research Grant program
- InVent
- AgriTech Accelerator
- Intergovernmental partnerships

PARTNERSHIPS WITH ACADEMIA AND INDUSTRY

FAST's collaborations with academic institutions and industry are essential to fostering the kind of generative dynamic between research and markets on which innovation thrives. We work with students, trainees, researchers, entrepreneurial initiatives and corporate entities in a bid to overcome some of the challenges experienced by each in their respective fields. Here, a key focus is bridging the gaps between the academic and business communities while strengthening the capacities of each in its own domain.

With our academic partners we enhance the quality and diversity of education in emerging fields such as AI, biotech and agritech while increasing academic and research output by expanding access to financial, networking and infrastructure support. Programs for apprenticeship and training, shared industry/academic lab infrastructure and scientific commercialization curriculum enable our partners to showcase their real-world significance and meet knowledge transfer goals while enhancing their exposure to and attractiveness for further collaboration, support and investment.

Meanwhile, we actively seek industry engagement in our programs to meet market needs and deepen connections between research output and commercial applications. This sees us co-opt established businesses in mobilizing resources to address human capital, infrastructure and network challenges. For corporate partners and sponsors, this provides access to apprenticeship and training programs, talent sourcing schemes, initiatives designed to explore solutions to industry problems and a plethora of networking opportunities in emerging areas of high-tech. Collaboration with FAST thus helps businesses to stay at the forefront of STEM innovation in Armenia and beyond through knowledge exchange, increased awareness and enhanced outreach.

In supporting Armenian startups, we also engage with entrepreneurial initiatives, like incubators, accelerators, angel investors and venture capitalists. Our work thus helps to enhance synergies across different initiatives and ensure complementarity between programs, allowing for more efficient resource use. We have already begun to canvass support from professionals from prominent and reputable Silicon Valley venture capital firms and accelerators. Over the longer-term, our aim is to draw larger accelerators and incubators to Armenia.

To understand the kinds of **collaboration opportunities we offer academic institutions, corporate actors and entrepreneurial initiatives**, look out for our work on various programs in the later segment, "**Navigating the Tide**":

- ADVANCE STEM Research Grant program
- Competitive Lab Infrastructure
- SciNova
- AgriTech Accelerator
- Apprenticeship
- InVent
- Fellowship
- Travel Grants
- Unit 1991's Education and R&D
- AI Bootcamp
- Global Innovation Forum
- Neruzh Diaspora Startup Program
- Global Partnerships and Collaborations

OUR FINANCES: PHILANTHROPY, INVESTMENT AND THE OPPORTUNITIES THEY OFFER

Over these first three years of seed sowing, FAST's financial resources have primarily been composed of philanthropic contributions. We are deeply indebted to our founders and the generosity of all other supporters who have joined us on our journey. Their continuous contributions have helped to bring a better and more innovative Armenia ever closer to the realms of possibility. Further details on the source of our funds and our spending for the reporting period are provided at the end of the segment entitled "*Our Foundation*".

At FAST we envisage and plan for this early-stage philanthropic funding to reap longer-term sustainability rewards by increasingly becoming matched with further private sector investment, including but not limited to impact investment. Certainly, this would be a natural outcome of Armenia's gradual emergence as a potential innovation leader. In the meantime, however, maintaining the advances we have made since 2017 will necessitate further philanthropic contributions. FAST will continue to leverage these precious resources to optimize the input-output ratio of its programming.

INDIVIDUAL DONORS AND INVESTORS

FAST's growing list of funders is indicative of the wealth of opportunities we offer individual donors and investors to advance not only Armenia and its innovation ecosystem but areas of science, technology and innovation of interest to them.

Individual donors choose to contribute either to specific programs and/or (increasingly) areas of focus, like AI, biotech, agritech, education or startup development. Other contributors donate to the overall work of the organization and its wider mission. This flexibility allows donors to align their resource allocations with their own priorities and goals. Moreover, FAST's investment structures, which require investment funds to be matched by philanthropic contributions, facilitate the pooling of donor contributions with those of individual investors to drive deeper impacts. Here, for example, philanthropic contributions to the fundamental sciences create research opportunities that enable investors to fund the application of that science through relevant startup and innovation schemes.

Indeed, FAST's programming meanwhile offers investors a progressively expanding range of opportunities to invest in science-backed Armenian innovation. FAST's Science and Technology Angels Network gives investors preferential access to Armenian startups that have benefited from international mentorship and early-stage guidance on commercial viability, including proof of concept, via our InVent and Advanced Solutions Center (ASCENT) programs. Our Life Science Incubator will offer access to a pool of biotech startups, while our AgriTech Accelerator offers the same for burgeoning agritech ventures. Access to startups going through our InVent program also currently offers a chance to obtain shares in ventures that have already reached prototype stage, guaranteeing a minimum viable product with which to progress. Such early-stage support from FAST can help to mitigate some of the risks often associated with the commercial viability and scalability of startups to ensure that those being invested in are truly investment worthy. FAST aims to expand its support further to additional startup growth stages in the future.

FAST's current work to structure two new venture capital schemes for our Invent and ASCENT programs offers further opportunities to invest in high-tech startups in the near future. Cumulatively, these schemes, together with STAN and our Life Science Incubator, build towards a larger investment opportunity in the form of our flagship Adaptive Innovation Campus and Innovation District program. This latter initiative represents a large-scale, long-term project with a ten year lifespan and notable opportunities for investment through the establishment of a microcosm of science, technology and innovation on Armenian soil.

To understand the kinds of **opportunities we offer individual donors and investors**, look out for our work on various programs in the later segment, **"Navigating the Tide"**:

- ADVANCE STEM Research Grant program
- Unit 1991's Education and R&D
- Life Science Incubator
- Science and Technology Angels Network
- Advanced Solutions Center
- InVent
- SciNova
- Innovation District and Adaptive Innovation Campus
- AgriTech Accelerator
- Startup Studio
- Aspiring Female Entrepreneurs Program

FOLLOWING THE CONSTELLATIONS

CHAPTER IN BRIEF

- Two **global initiatives** aid FAST to gauge its progress towards its immediate and higher aims: the Global Innovation Index and the United Nations Sustainable Development Goals.

- The last three years have seen FAST programming directly target 34 of **80 GII indicators**. Of these, 23 have already been impacted by 20 programs, and further impacts are due to be felt upon completion of ongoing programs. In total, 85% of 20 FAST programs assisted or will assist indicators in the Business Sophistication pillar, 65% to the Knowledge & Technology Outputs pillar, 60% to the Human Capital and Research pillar, 25% to the Market Sophistication pillar and 20% to the Creative Outputs pillar.

- Of **26 implemented programs**, 18 support SDG4 Quality Education, 15 support SDG9 Industry, Innovation and Infrastructure, 16 support SDG17 Partnership for Sustainable Development and 11 support SDG8 Decent Work and Economic Growth. SDGs 5 Gender Equality and 12 Responsible Consumption and Production are supported by one program each.

In plotting a course towards Innovative Armenia 2041, macro-level goals and indicators have been our constellations both in determining where we are and where we need to go. Two global initiatives have provided us with the framework to gauge that progress: the Global Innovation Index (GII) and the United Nations Sustainable Development Goals (SDGs).

Here, we present an overview of how we have sought to contribute to advancing Armenia's standing through these initiatives.

CONTRIBUTING TO THE GLOBAL INNOVATION INDEX PERFORMANCE

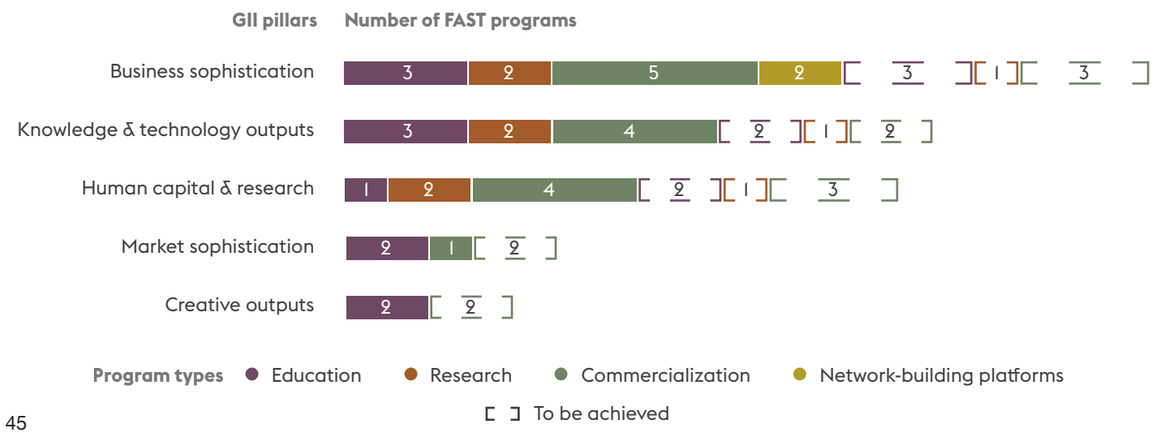
The GII is the leading index for innovative countries in the world. The index uses seven input-output pillars and 80 correlating indicators to capture those elements of the national economy enabling innovation, as well as actual evidence of innovative output. As such, it offers FAST the milestones needed to guide and benchmark our strategy for Armenia's technological leapfrogging.

Armenia currently ranks 61st among 131 countries on the GII. The last three years of FAST activities have directly targeted 34 of the GII's 80 indicators. Notably, however, numerous other GII indicators have also been indirectly assisted as a secondary effect of FAST's program implementation. For example, many of our capacity building activities have already resulted in new publications or will indirectly lead to the creation of knowledge-intensive employment. As such, they assist different GII indicators to those forming part of our current analysis. However, as these secondary impacts are difficult to capture at this stage, having yet to mature fully, the present analysis restricts itself to the indicators directly impacted by FAST's work.

Of all 26 implemented programs analyzed by FAST, some did not directly contribute to any selected GII indicators. Of the 34 GII indicators directly targeted by FAST's strategy, 23 have already been assisted through 20 programs, while another 3 indicators will have been further assisted upon completion of 7 currently ongoing programs.

In addition to targeting GII indicators through its program work, FAST also makes its own modest contribution to GII advancement as an institution. Here, our organization's contribution to things like relevant employment and overall R&D expenditure touches on a number of indicators in the index, as depicted.

Graphic 2.1. Number of programs assisting GII, by pillar and type

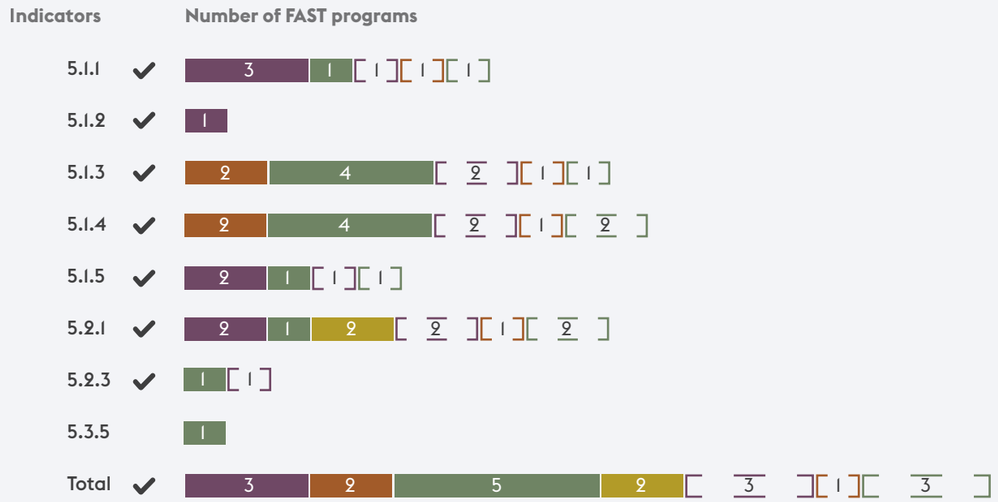


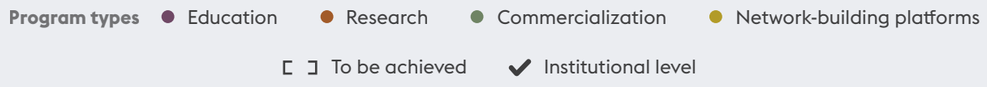
34 selected GII indicators, by pillar		Status
Human Capital and Research		
2.1.4	PISA scales in reading, math and science	Not assisted
2.2.1	Tertiary enrolment, % gross	Assisted
2.2.2	Graduates in science and engineering (% of total tertiary graduates)	Assisted
2.2.3	Tertiary inbound mobility, %	Assisted
2.3.1	Researchers, full-time equivalent (FTE) / million population	Assisted
2.3.2	Gross expenditure on R&D, % GDP	Assisted
2.3.3	Global R&D companies, average expenditure, top 3	Assisted
2.3.4	QS university ranking average score of top 3 universities	Not assisted
Market Sophistication		
4.2.3	Venture capital deals / billion PPP$ GDP	Assisted
4.3.3	Domestic market scale / billion PPP$	Assisted
Business Sophistication		
5.1.1	Knowledge-intensive employment, %	Assisted
5.1.2	Firms offering formal training	Assisted
5.1.3	GERD performed by business enterprise, % GDP	Assisted
5.1.4	GERD financed by business enterprise, %	Assisted
5.1.5	Females employment with advanced degrees, %	Assisted
5.2.1	University / industry research collaboration	Assisted
5.2.2	State of cluster development	Not assisted
5.2.3	GERD financed by abroad, %	Assisted
5.2.5	Patent families filed in two offices / billion PPP$ GDP	Not assisted
5.3.1	Intellectual property payments, % total trade	Not assisted
5.3.4	FDI net inflows, % GDP	Not assisted
5.3.5	Research talent in business enterprise / thousand population %	Assisted
Knowledge & Technology Output		
6.1.1	Patent applications by origin / billion PPP$ GDP	Not assisted
6.1.2	PCT applications by origin / billion PPP$ GDP	Not assisted
6.1.3	Utility models by origin / billion PPP$ GDP	Not assisted
6.1.4	Scientific & technical articles (publications) / billion PPP$ GDP	Assisted
6.1.5	Citable documents H-index	Assisted
6.2.1	Growth rate of PPP$ GDP / worker, %	Assisted
6.2.2	New business / thousand population 15–64	Assisted
6.2.5	High-tech and medium-high-tech output, %	Assisted
6.3.1	Intellectual property receipts, % total trade	Not assisted
6.3.2	High-tech net exports, % total trade	Assisted
6.3.3	ICT services exports, % total trade	Not assisted
Creative Outputs		
7.1.4	ICTs & organizational model creation	Assisted

BUSINESS SOPHISTICATION

In total, 85% of programs have contributed or will contribute to the Business Sophistication pillar. Of 15 indicators in this pillar FAST directly targets 12, of which 5.1.3 (GERD performed by business enterprise), 5.1.4 (GERD financed by business enterprise) and 5.2.1 (University/industry research collaboration) have received the greatest support, each having been targeted by 5 to 6 programs. Another 4 to 5 programs will further target these same indicators in the future.

Graphic 2.2. Business sophistication indicators assisted by FAST programs, by type

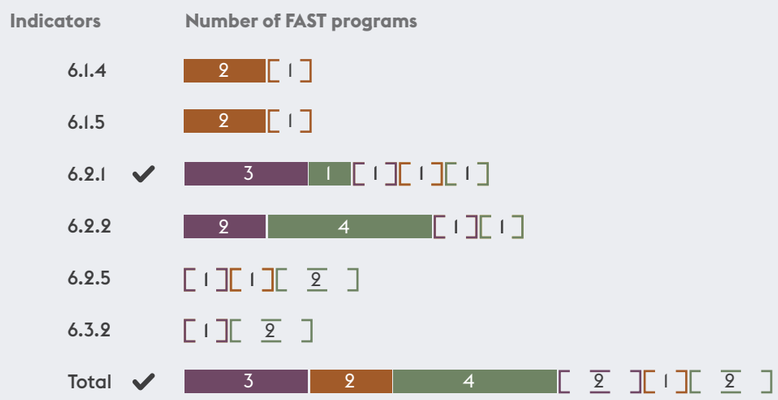




KNOWLEDGE & TECHNOLOGY OUTPUTS

To date, 65% of programs have already contributed to indicators included in this pillar. FAST programs directly target 11 out of 14 relevant indicators, of which the most affected by FAST programming so far is 6.2.2 (New business per thousand population at 15-64 ages).

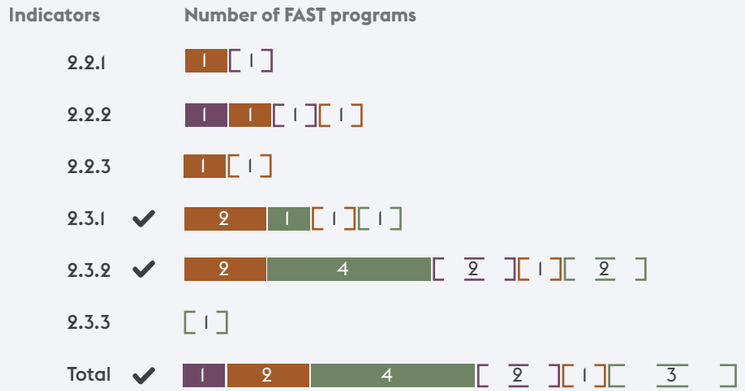
Graphic 2.3. Knowledge & technology output indicators assisted by FAST programs, by type



HUMAN CAPITAL AND RESEARCH

In total, 60% of programs have contributed and/or will contribute to different indicators under this pillar. Of 12 indicators in the pillar, 8 have been directly targeted by FAST programming. The indicator receiving the greatest support over this period has been 2.3.2 (Gross expenditure on R&D, % GDP) to which 6 programs have contributed and 5 ongoing programs are yet to contribute.

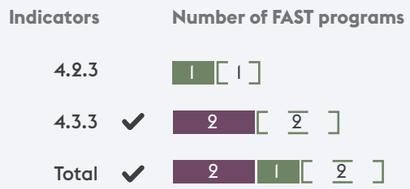
Graphic 2.4. Human capital and research indicators assisted by FAST programs, by type



MARKET SOPHISTICATION

Only 2 out of 9 indicators from the Market Sophistication pillar have been directly targeted by FAST through 25% of programs.

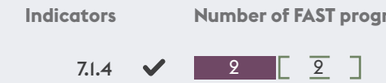
Graphic 2.5. Market sophistication indicators assisted by FAST programs, by type

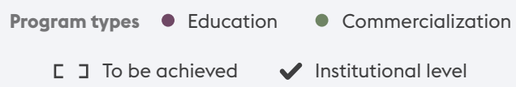


CREATIVE OUTPUTS

Of 13 indicators in the Creative Outputs pillar only 1 is directly targeted by 20% of our entrepreneurial programs.

Graphic 2.6. Creative outputs indicators assisted by FAST programs, by type





CONTRIBUTING TO THE SUSTAINABLE DEVELOPMENT GOALS

The dedication with which our mission is pursued is grounded in a desire to bring about the deep benefits that STI advancement can bring to Armenia and its international offering - namely, sustainable local, national, regional and international development. As such, our programming consciously contributes to the United Nations Sustainable Development Goals by using the attainment of SDG targets and indicators as objectives and impact metrics.

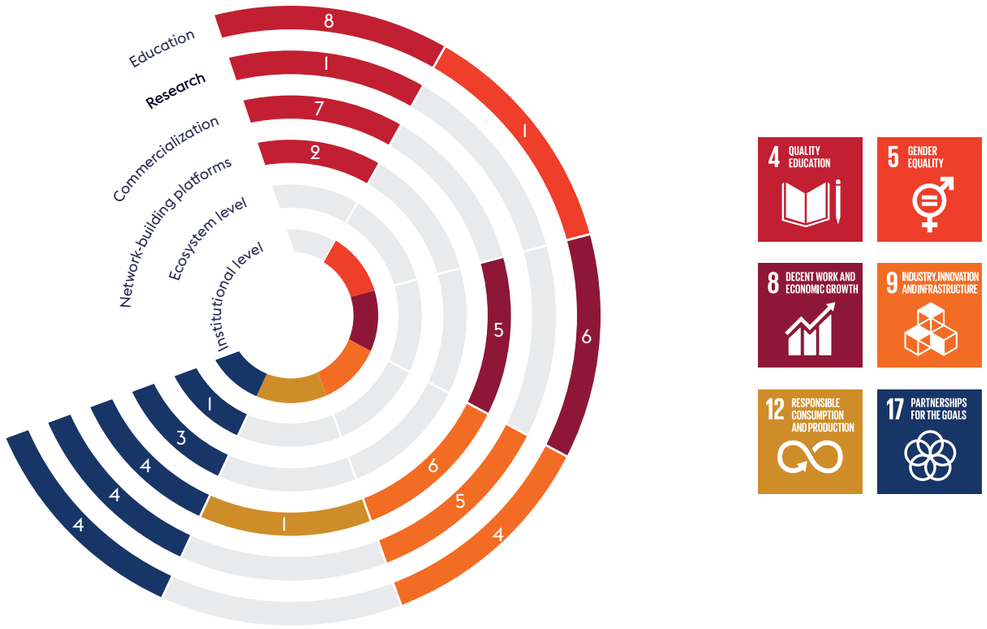
WHAT ARE SDGS AND WHY ARE THEY IMPORTANT

The SDGs are a set of 17 goals and 169 targets aimed at resolving the challenges faced by peoples and nations across the globe, including poverty, inequality, climate change, environmental degradation, peace and justice. They offer a 15-year roadmap to achieving a better and more sustainable future for all by 2030. The SDGs recognize that development is possible only if there is a balance between social, economic and environmental sustainability. As such, they aim to impact all levels of society, reach across all sectors and embrace equity, inclusion, and universality.

The emphasis of the SDG framework on the interdependent and integrated nature of SDGs makes them highly complementary to FAST's own approach to STI programming. At FAST we recognize that our ability to harness the deep benefits of an Innovative Armenia to meet prevailing social, economic and environmental needs requires engagement with some complex sustainability challenges. However, tackling these challenges can only truly be done in collaboration with others. The SDGs offer a universal and visionary framework to align such global cooperation to the extent that they facilitate the creation of shared value and a broader shared vision for all.

The last three years of programming has seen FAST contribute to 6 SDGs. Of 26 implemented programs, impacts on SDGs are already discernible for all but one. Of these, 18 programs have contributed to SDG4, which makes 'Attaining Quality Education' the SDG receiving the greatest emphasis in FAST's programming for this reporting period. Along with SDG4, SDG9 Industry, Innovation and Infrastructure and SDG17 Partnership for Sustainable Development are of primary importance, while we also contribute to SDG5 Gender Equality, SDG8 Decent Work and Economic Growth and SDG12 Responsible Consumption and Production.

Graphic 2.7. FAST impact on SDGs



PRIMARY IMPACTS

SDG 4

Thus far, **18 programs** have contributed to **ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all** by substantially increasing the relevant skills needed for decent work and entrepreneurship. We have provided a total of over **2,000 hours** of deep training and knowledge transfer opportunities in respect of science, technology and innovation. This has included field-specific training for over **700 students, industry representatives, future conscripts, entrepreneurs and investors**. It has also included knowledge transfer opportunities for over **1,600 participants**, from a variety of backgrounds, predominantly through workshops, master classes and other educational events. In addition, **49 scholarships and grants** have been awarded. These have given 28 young students and professionals advanced AI training, while offering 19 PhD STEM students a chance to focus on their research activities unhindered through the provision of necessary financial and institutional support. In addition, we have contributed to entrepreneurial education through a number of awards and opportunities offered to promising entrepreneurs and startup teams.

SDG 9

In total, **15 programs** have contributed to building **resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation** by enhancing scientific research and upgrading the technological capabilities of industrial sectors. Since early 2018, **65 researchers** have been supported with a view to raising Armenia's R&D capacity, including 49 recipients of direct funding. Starting from autumn 2020, 6 researchers receive funding through the ADVANCE STEM Research Grant program. Meanwhile, FAST support through its Fellowship and Travel Grant for Collaborative Research programs has helped generate about **70 papers** in various international journals. In general, 13 Armenian and 20 international academic institutions were engaged in supporting this SDG. Technology development, research and innovation in Armenia have also been advanced through FAST initiatives building startup capacities, attracting venture capital and expanding networks, benefitting **75 Armenian tech startups**.

SDG 17

In total, **16 programs** have contributed to **strengthening the means of implementation and revitalizing the Global Partnership for Sustainable Development**. FAST's expertise has helped strengthen sustainable development implementation through its contribution to six international donor studies and its open sharing of data and analyses with development-focused entities, among others.

The 2017 NSF-FAST Workshop on Machine Learning for Discovery Sciences brought together nearly 300 participants to bridge national and international intellectual communities. Meanwhile, our Global Innovation Forum has since developed as a platform to foster ties between, so far, over 3,400 representatives of academia, industry, government and international organizations in the field of science and technology innovation. These are the two most significant of over **80 networking opportunities** involving over **6,000 participants** that FAST has organized over the last three years to lay the ground for generating further partnerships in the sphere of STI, both nationally and internationally.

Indeed, our own partnerships and joint initiatives engage a diverse pool of academic, state, industry and innovation collaborators united in pursuing the broad aims of FAST's vision. Some of our collaborations are first of their kind for Armenia in either scope or parties involved, including intergovernmental partnerships among Armenia, Rwanda and Indonesia, which allow for mutual capacity building and open new potential avenues for trade. Currently, FAST's partners network includes about **70 partner organizations** and over 10 strategic partnership agreements and MoUs.

SECONDARY IMPACTS

SDG 5

We have committed to ensuring that our programs and initiatives **achieve gender equality and empower women and girls**. We put an emphasis on ensuring gender balance across all our initiatives and offer structured programs with seats specifically allocated for women, including our fellowship for talented STEM doctoral students and our Aspiring Female Entrepreneurs Program. The numbers speak for themselves: around 30% of our educational beneficiaries are women, and 55 startups (59%) enrolled in our various programs are led by women or have women in their leadership team. Moreover, at an institutional level, 66% of FAST's permanent recruitments have been women.

SDG 12

As an institution, FAST has sought to enshrine **sustainable consumption and production patterns** within its organizational culture, in part by following office practices geared at ensuring sustainable and environmentally friendly use of office space to reduce energy costs, water waste, plastic usage and ensure better waste management.

SDG 8

The last three years have seen FAST contribute to **promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all** in creating 47 permanent and 63 temporary direct jobs. Over 300 interns and volunteers have also been engaged and trained in our programs and activities. Furthermore, FAST events have seen over 220 international business tourists visit Armenia, indirectly supporting jobs across the tourism value chain with an additional tourist expenditure of over 520,000 USD. Finally, our training, startup programs and research initiatives have engaged over 800 young people in educational, employment or entrepreneurial activities for the period of one month or more contributing to the enhancement of knowledge-intensive labor in Armenia.

NAVIGATING THE TIDE

CHAPTER IN BRIEF

- FAST has produced over **21 research papers** and contributed to **8 major reports** by international organizations.
- We have implemented **26 programs** in total, including 8 in Education, 6 in Research, 6 in Commercialization, 2 at Ecosystem Level and 4 Network-building platforms. Of these 26 programs, 10 are ongoing.
- By December 2020, an additional **10 programs** were either in the planning stage or temporarily put on hold due to prevailing COVID-19-related challenges, **ready for implementation** once these challenges are overcome.
- Over its first 3 years FAST has engaged **over 5,600 beneficiaries** through its programs, including 500 entrepraeneurs with more than 200 startups, almost 100 researchers, and 136 future conscripts.
- We have provided **deep training and knowledge transfer opportunities** to over **2,300** individuals, including students, industry representatives, future conscripts, entrepreneurs and investors in subjects of data science, artificial intelligence, corporate innovation and entrepreneurship, among other topics.
- We have provided funding to **49 researchers**, supported **23 international research collaboration projects** and hosted nearly **100 foreign researchers** in Armenia through a variety of initiatives. As a result of several programs, **25** visits to international labs have been conducted and around **70 scientific papers** produced, of which 50 have already been published in international journals.
- FAST has launched **science-intensive venture builder programs** – ASCENT and InVent – as well as **Armenia's first Angel group** – the Science and Technology Angels Network – which unites **25** prominent professionals from all over the world who are committed to invest 10,000 USD annually.

EVIDENCE-BASED PROGRAMMING: FAST AS A THOUGHT LEADER

Our evidence-based approach to programming has already seen FAST start to become a notable point of reference on the various challenges facing STI in Armenia. We have engaged in extensive research and analysis to create programming and content that consistently responds to the most pertinent needs of Armenia's STI ecosystem. In doing so, we have drawn upon the significant expertise and experience of those in our team and our broader networks.

To date, we have produced over 21 research papers on issues such as:

- the international experience of advancing science and innovation, including benchmarks and analysis;
- the future of science and technology internationally and Armenia's potential placement within such evolving global value chains, including priority areas for Armenia to develop niches;
- the current state of science and technology in Armenia, including assessments of the country's human capital potential, infrastructure, research funding availability and quality of research output;
- the Armenian venture industry, including the absorption capacity of the local market in respect of venture funding now and in five years.

FAST's strategic outlook on Armenia's technological leapfrogging has been built upon this body of evidence. This outlook sets out a range of potential scenarios and outcomes of interventions (including our "moonshot" Innovative Armenia 2041 scenario) on the basis of GII performance and comparable experiences elsewhere.

In the last three years, we have also contributed to 8 major reports conducted by international organizations and key ecosystem builders. *Realizing Armenia's High-Tech Potential*, published by the World Bank in January 2020, and *Investment Policy Review*, published by UNCTAD in 2019, are of particular note. Indeed, many of the World Bank's own conclusions have verified numerous findings within FAST's strategic outlook. Such alignment helps to foster greater collaboration in achieving the ultimate objective of building Innovative Armenia.

OUR PROGRAMS: AN OVERVIEW

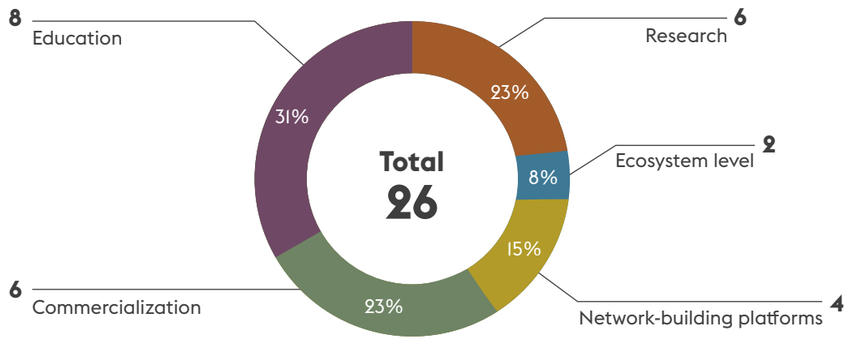
Since 2017, we have implemented a total of 26 programs targeting the three STI pillars, in addition to starting several other ecosystem level (cross-sectoral) projects and network-building platforms. Over this period FAST has engaged over 5,600 beneficiaries through its programs, including 500 entrepreneurs with more than 200 startups, almost 100 researchers and 136 future conscripts.

2017 to 2018 was largely spent laying the groundwork for actual programs, though two programs were also launched during this time. 2018 to 2019 saw us launch a further 13 programs. Of these, 10 were continued into the financial year (July-June) of 2019-2020, while one was completed, another reshaped and integrated into a different program launched in 2019-2020, and one was suspended due to impact concerns in light of emerging budgetary challenges. In 2018 we also started the research and planning for our Adaptive Innovation Campus (AIC) – a FAST flagship initiative.

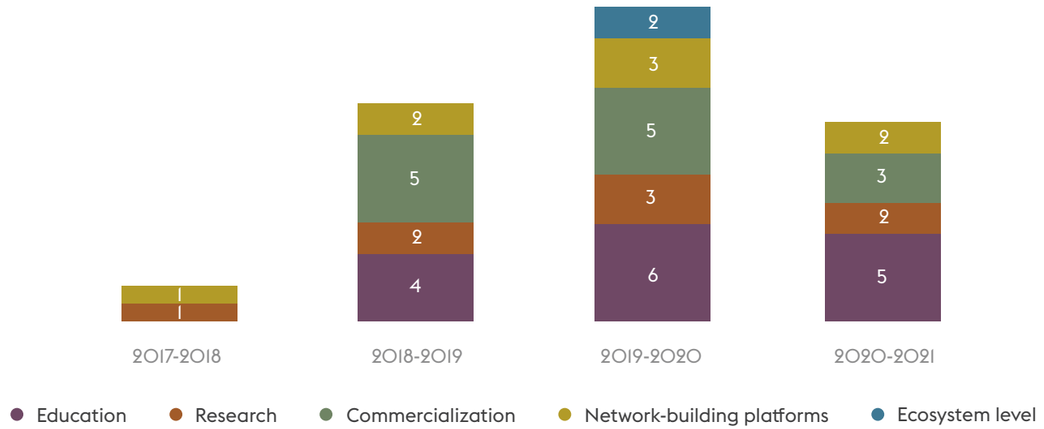
In the financial year 2019 to 2020 FAST launched a further 9 programs, in addition to continuing the ongoing work of implementing programs launched in 2018-2019. Of these latter programs, 2 were subsequently completed, while 1 new program was launched and 8 were continued through second batches or scale-ups. 2019-2020 also saw a further 5 programs designed and prepared for implementation, though their launch was deferred due either to COVID-19 or the need for further fundraising.

The current financial year (2020 to 2021) has seen FAST go on to launch an additional 2 programs, as well as continuing the work of ongoing initiatives launched in 2019-2020. Of these earlier initiatives, 1 has been spun off into a separate legal entity, 1 completed, and 2 new programs were launched. Meanwhile, 8 programs have been continued through second batches or scale-ups. The first 6 months of 2020-2021 financial year also saw a further 4 programs designed and prepared for implementation. Their launch is foreseen for 2021.

Graphic 3.1. Programs for 2017-2020 financial period, by type



Graphic 3.2. Number of programs undertaken in each financial year, by type

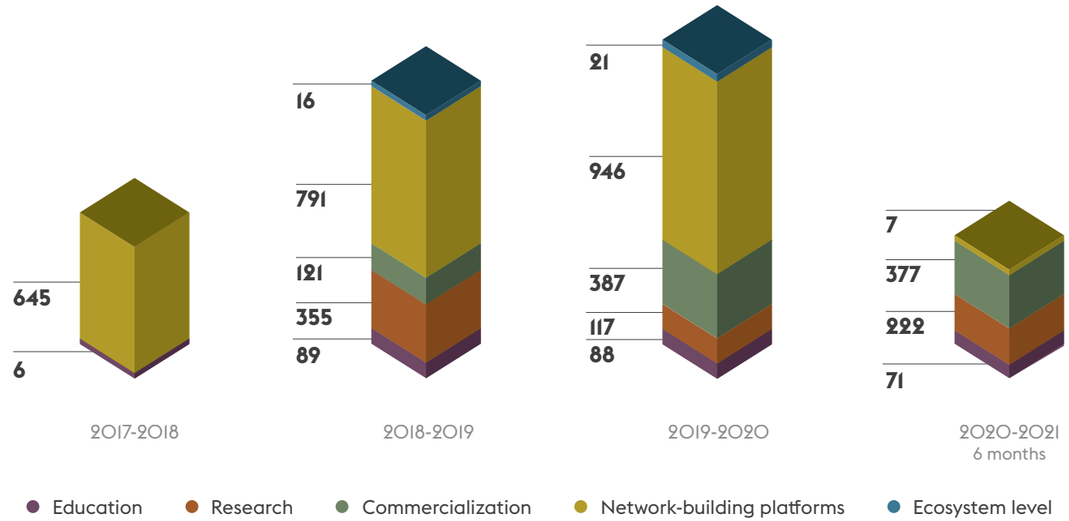


Note: The above graphic includes programs implemented over more than one financial year, hence the appearance of more than 26 implemented programs.

2020 also saw the continuation of work to develop a full program package for our AIC together with partners in government, international donor organizations and private entities. These discussions saw the original AIC concept grow into an Innovation District with various components. Concepts for a further 10 programs concepts were also explored by FAST over this time, though were found to be unsuitable for current adoption due to feasibility, cost-benefit or other challenges.

The below graphic visually represents FAST program distributions and costs according to STI pillar and financial year. The relative higher expenditure on network-building platforms is due to the fact that this segment of programming involved several large-scale initiatives, such as the NSF-FAST Workshop on Machine Learning for Discovery Sciences, the Global Innovation Forum and international roadshows (as outlined below).

Graphic 3.3. All program costs for 2017-2020 financial period, in thousands USD, by pillar



Impacts of COVID-19 on FAST programming

COVID-19 has had a notable impact on our Foundation's plans and programs. The financial crisis triggered by the pandemic has significantly affected the philanthropy world from which most of FAST's funding is derived, occasioning both reduced funding and fewer fundraising opportunities. This, and feasibility challenges for program implementation during lockdown and in high-risk settings, saw the implementation and execution of plans for several projects, including some of our biggest, deferred or suspended. Here, pre-confirmed or confirmed grants relating to programs that had been deferred or suspended were also cancelled.

OUR PROGRAMS IN DETAIL

To give a clearer picture of the types of intervention in which FAST engages and the wealth of opportunity such interventions offer our beneficiaries, our partners and us, below we provide a more detailed account of some of FAST's key programs.

These accounts offer a snapshot of 7 programs implemented under the education pillar, 4 under the research pillar and 4 under the commercialization pillar. They also outline 2 ecosystem level programs and 3 network-building platforms. This includes insights into some of the issues that these programs have sought to address, the solutions they offer, and the implementation results they have seen thus far. In some cases, it also includes an overview of some of the challenges encountered during implementation – matters instructive in determining both how to develop implementation further and what to take into account on similar ventures.

EDUCATION

FAST recognizes the crucial role of academic and industry experts and professionals in advancing Armenian STI. As such, many of our programs place a strong emphasis on education, capacity building and the enhancement of Armenia's intellectual capital.

Our programming over the last years has also paid particular attention to educational enhancement in **data science** and **artificial intelligence**. In 2019 we ran an advanced training for soldiers serving in special detachments of the Armenian army, which later evolved into the Ministry of Defense's **Unit 1991 Education and R&D** program. We also launched an **AI Bootcamp**, mainly for industry professionals, with a view to addressing future programming needs for advanced data scientists and AI specialists, as well as supporting labor market demands for professionals with industry-relevant knowledge and skills. The need to address Armenia's labor shortage in industry-primed professionals had originally seen FAST launch an **Apprenticeship** program in 2018. This program piloted a new framework for on-the-job training with several leading Armenian IT companies.

FAST's educational programming also targeted entrepreneurial knowledge and skills enhancement as early as 2018. That year saw us establish entrepreneurial training programs for startups and budding entrepreneurs in the form of a **Startup Studio** program. 2019 then saw us go on to run the **Aspiring Female Entrepreneurs Program** together with partners from Aston University. In 2020 we launched an **AgriTech Accelerator** in partnership with the UNDP ImpactAim Venture Accelerator and the Armenian National Agrarian University.

A number of programs currently under design aim to advance STEM education in Armenia. For example, newly approved educational programs like **SciNova**, which offers a curriculum on research design and science commercialization, aim to help orient Armenia's aspiring STEM talent towards research and innovative work attuned to commercial viability.

FAST's education-targeted programs have provided domain-specific training for over **700** individuals, as well as knowledge transfer opportunities for an additional **1,600** participants, from a wide variety of backgrounds. These trainings and events have enhanced capacity in core innovation subjects like data science, artificial intelligence, corporate innovation and entrepreneurship, among others.

Key programs under this pillar are presented below, along with feedback from participants.

Education

STARTUP STUDIO

PROGRAM DESCRIPTION

Problem

Armenian startup numbers have been rising for the last decade: an EIF report on Armenia's ICT industry found 150 new companies created in 2018 alone, with an average 116 companies created annually between 2000 and 2019. Many successful companies have been established by stimulating further industry development and inspiring budding entrepreneurs to build their ventures. However, in 2018 there were few accelerators supporting science and technology-backed startups to enhance their knowledge in entrepreneurship or access mentorship, funding or a vibrant environment.

Solution

FAST created a platform to support science and technology-backed startups through a coaching and mentorship program, as well as providing access to coworking spaces at FAST's Creative Campus. The 3-month program helped startups to undertake the entrepreneurial journey with modules specifically designed to cover their needs. The program consisted of business and technical sessions, teamwork, panel discussions, mentor engagements, motivational talks and interactive games. It also involved the organization of demo days for pitches to investors.

The program offered a separate track for budding entrepreneurs to introduce and develop entrepreneurial culture among them and provide fundamental knowledge and practical skills to serve as a base for participants to create their ventures.

Results

Three batches of startup development sessions were organized. In total 44 startups participated, each benefiting from 12 learning modules, the mentorship program and access to the vibrant environment of FAST's Creative Campus. The two demo days for pitches were attended by 160 participants.

A total of 16 startup coaches supported participating startups, and 28 startups pitched to STAN investors, with one successfully raising a pre-seed investment of 50,000 USD.

Overcoming Challenges

- Participation in coaching sessions was compromised by the fact that startups were in different development phases, and some sessions were not relevant for those startups that had already participated in other incubation programs.
  This was taken into account in subsequent entrepreneurial programs through the implementation of a system of elective courses.

- Even after completing the program, many startups failed to demonstrate sufficient potential for scaling to be eligible for investment due to a lack of commitment from founders and their limited understanding of market needs.
  To mitigate this issue for future programs, a methodology was developed to engage participants more actively and improve knowledge of startup development mechanics.

- There were few promising science-focused startups available for recruitment, and toward the end of the program, there were other well-established incubation and pre-acceleration programs capable of supporting the few that did exist.
  This drove FAST to focus its efforts on startup building rather than support.

CAPACITY

Intellectual | Financial | **Network**

Timeline
Aug 2018 - Jan 2019

Status
Completed

IMPACT INDICATORS

Batches completed
3

Budding entrepreneurs trained
11

Training hours conducted
172

Membership to startups granted
44

Startups pitched to investors
28

GII INDICATORS

SDG TARGETS

Education

ASPIRING FEMALE ENTREPRENEURS PROGRAM

PROGRAM DESCRIPTION

Problem

Although there is no recent data on the proportion of women entrepreneurs in leadership positions in Armenia, the country is no exception to the global phenomenon of the rise of women entrepreneurs. However, in the regions where women are significantly less empowered to take an active role in the intellectual workforce, few women go into either science or entrepreneurship. Moreover, our experience in entrepreneurial programs has demonstrated that a scarcity of female scientists establishing innovative science-focused startups is another major issue.

Solution

As an organization seeking to empower women in science and entrepreneurship, a program for aspiring female entrepreneurs was designed to help women obtain the necessary tools for conceiving, developing and launching a science and technology-backed startup. The program specifically targeted participants from the regions using an online format.

The rigorous 2-month program aimed to introduce and develop an entrepreneurship culture among participants by providing fundamental knowledge and practical skills as a base for these entrepreneurs to create their ventures. It culminated in a demo day for graduates to pitch to a large audience of investors, entrepreneurs, technology leaders and other related groups. The most promising startups gained an exceptional chance to enroll in the Startup Studio program.

Results

In total, 67 aspiring female entrepreneurs from all regions of Armenia participated. The program saw the creation of 19 startups, of which 4 were generating revenue by the end of the program. Some 16 coaches helped to support participating startups within the scope of 12 learning modules.

The **demo day** was attended by 110 participants and saw 2 teams receive 1,000 USD and 500 USD prizes. Two **workshops** were also organized by Aston University on Data Science and Enterprise & Entrepreneurial education for field professionals and incubator managers.

Overcoming Challenges

- As there were a limited number of participants with a scientific background available for recruitment, many ideas selected for the program were not science-focused. The main driver of this issue is the lack of an environment for scientists to engage in entrepreneurship.
  FAST intends to mitigate this issue in future through the provision of training programs for PhD students and scientists on innovation processes and science commercialization, such as the SciNova program to be implemented in early 2021.
- Other commitments saw many participants struggle with full attendance, with some dropping out or having to be excluded from the program.
  In future, participants' engagement will be subject to ongoing assessment throughout the program and taken into account as part of their final evaluation in competing for grants or investments.

BRITISH COUNCIL Aston University BIRMINGHAM UK

This program was implemented jointly with Aston University (UK) within the framework of the Creative Spark: Higher Education Enterprise Programme funded by the British Council.

CAPACITY

Intellectual | Financial | **Network**

Timeline
Jan - Jun 2019

Status
Completed

IMPACT INDICATORS

Female entrepreneurs trained
67

Training hours conducted
80

Startups created
19

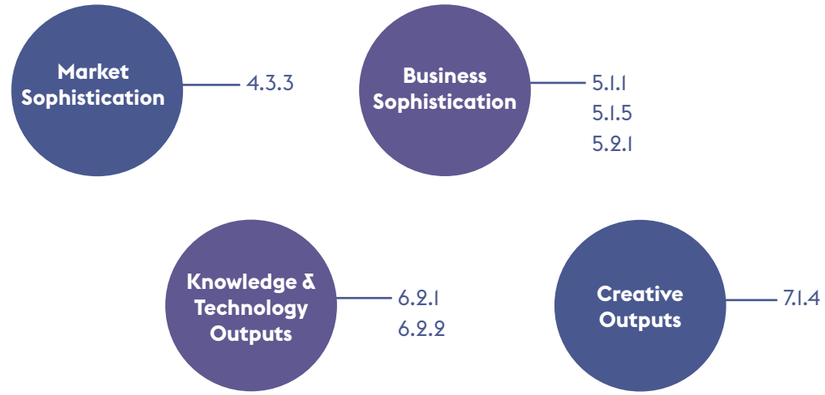
Participants in Demo Day involved
108

Entrepreneurial handbook published
1

Professionals trained
51

Startups for CS Enterprise Pitch Competition nominated
9

GII INDICATORS



SDG TARGETS

Startup Studio provided access to an awesome network of investors and training. Through coaching received from program experts, we got great insight on how to improve our business model. Funding and workspace provided through the program was also key to launching and further developing our startup.

Haik Kazarian
Co-CEO, Smart Apaga, Armenia

Hayk Manukyan
CEO, Haylend, Armenia

FAST's Startup Studio opened a number of closed doors for our startup. Ongoing mentorship provided by the program helped us become more powerful, responsive to upcoming challenges, and most importantly, believe that we would succeed.

Adelina Oganezova
Co-Founder and Commercial Director, KANGAROO, Armenia

AFEP was truly a booster for me as a founder. Before joining the program I had no idea about how to establish and lead a startup. I also didn't have much confidence in my decisions and steps. Thanks to the program I successfully shaped my product and confidently started my startup journey. The program team was ready to encourage and support even my craziest ideas, which was a great motivation!

Education

APPRENTICESHIP

PROGRAM DESCRIPTION

Problem

Armenia's rapidly developing ICT sector has generated a mismatch between supply and demand in the tech labor market, signaling an important disconnect between education and industry. Many students, especially in STEM, therefore abandon proper engagement with study in order to start working, often full-time. Headhunted young talent ends up being deprived of opportunities for fundamental education, which, in turn, hinders their long-term professional growth. At the same time, academic programs in Armenian higher education institutions remain highly theoretical and do not prepare students for a smooth transition into the labor market upon graduation. This creates the perception that theoretical knowledge is not useful in a practical setting, which negatively impacts students' motivation to engage in formal education. Many companies highlight a lack of skilled graduates resulting in inefficient resource use due to the constant need for staff recruitment and development.

Solution

FAST established a new framework for on-the-job training with leading Armenian IT companies that can be combined with formal education. Participants are composed of students who spend about 10 hours a week with the host organization for up to one year. Supervisors in the hosting company set individual learning plans for their students and assess their performance according to the methodology developed within the program. The program aims to transform the industry into a knowledge-generator and, in the long run, modify the university curriculum to take into consideration industry needs.

Results

In the **1st batch**, 42 students were selected to participate in the program from 2019 to 2020. They were involved in a number of different departments at one of the leading and largest IT companies in Armenia, SoftConstruct. After several months of training, many students had already been offered a job at the company with a flexible schedule that would not conflict with their studies.

In the **2nd batch**, 18 students were selected to participate with four leading IT companies – EPAM, Digitain, SoftConstruct and SFL – from 2020 to 2021. The team leads of each participating company were introduced to the academic component of the program and trained on how to ensure the learning path for each student. This program underwent some changes due to the COVID-19 pandemic.

Accumulated expertise was also shared with the Government of Armenia in December 2019 to integrate best practices into a unified nationwide process to reform the professional internships model implemented in universities. This has seen the program in its current form temporarily suspended.

Overcoming Challenges

- Many talented students starting from their second year of study are already being actively headhunted by companies, thus intercepting many potential candidates for the program. Also, as most higher education institutes do not equip students with hard and soft skills, many companies are reluctant to hire students who require a lot of individual guidance.
- Many IT companies have developed customized solutions to address their growing demands for a qualified workforce. The program is viewed by them as one of those solutions.

Making this program an integral part of a nationwide systematic approach to closing the gap between academia and industry would help drive solutions to generating work-ready graduates away from individual efforts, thus cutting down on an inefficient use of public and private sector resources.

CAPACITY

Intellectual **Financial** Network

Timeline
Dec 2018 - Mar 2020

Status
Completed

IMPACT INDICATORS

Participants selected
42 / **18** | of which females **27** / **11**

Companies engaged
1 / **4**

Participants graduated
42 / **18**

Universities impacted
6 / **6**

Batch 1
Batch 2

GII INDICATORS

SDG TARGETS

Education

AI BOOTCAMP

PROGRAM DESCRIPTION

Problem

A recent Catalyst tech survey found nearly half of companies experience a large or severe deficit in skilled workers, especially in narrower specializations. Over 50% of companies consider acquiring junior talent to be a challenge of reasonable to extreme severity. This further highlights the overarching need for education and training courses to bridge the gap between fundamental knowledge and its practical application in industry.

Armenia's dynamic IT sector expansion, as well as the emerging AI market, have added to the burgeoning rise in global demand for AI professionals. This has further strained the gap in current levels of supply and demand. Furthermore, FAST's programs aiming to advance AI in Armenia require a stable supply of high-quality professional talent.

Solution

A 12-week intensive course on data science and AI has been designed to aid participants to transition effectively to or develop a career in the field. The course includes workshops and specialized modules on developing creative ideas, entrepreneurial innovation, generative algorithms, deep reinforcement learning, chemoinformatics, graph neural networks and time series, and hybrid models for algorithmic trading, among other topics. It provides high-quality skills and in-depth AI training, while creating a talent pipeline for the Advanced Solutions Center and other initiatives using top graduates. As an indirect outcome, it also helps partner companies to shape AI R&D centers and teams using capstone projects designed around practical industrial problems identified by these companies and ASCENT.

Results

2019 saw 28 academic and industry participants receive advanced DS and AI training. 5 were granted full scholarships, and 10 partial funding by FAST. The course culminated in the presentation of 6 capstone projects addressing industry problems in Armenia and abroad. The second AI Bootcamp started in October 2020 with 19 participants. Among them are 3 Rwandan participants, engaging within the framework of an MoU signed with the Rwandan Government in March 2020 to support knowledge and technology transfer to Rwanda. Two of the formal partners for this second AI Bootcamp are Cynora and IntelinAir. Cynora provides scholarships to 5 students and is co-supervising a capstone project alongside FAST. IntelinAir is providing 4 scholarships.

Overcoming Challenges

- Due to the COVID-19 pandemic it became impossible to organize the program offline.
  Considerable effort has gone into ensuring a safe and effective learning experience through a combination of online lectures and hands-on practical sessions in small groups.

CAPACITY

Intellectual | Financial | Network

Timeline
Oct 2019 - Feb 2021

Status
Ongoing

IMPACT INDICATORS

Participants trained
28 / **19**
- of which industry representatives
  20 / **9**
- of which students
  5 / **10**
- of which researchers
  3
- of which females
  10 / **11**

Scholarships granted
15 / **13**
- of which full
  5 / **13**
- of which partial
  10

Training hours conducted
100 / **40***

Batch 1
Batch 2

* as of 30 December 2020

NO GII INDICATOR ASSISTED

SDG TARGETS

Primary
4.4. **4.b.**
Secondary
4.3.

It's not a stretch to call my experience with the AI Bootcamp life-changing. It really helped me solidify my career choice and narrow down my graduate school focus. Working on the final project under the supervision of one of our mentors made me realize that I really enjoy doing research and this is exactly what I want to do in the future. Fast forward six months, I ended up working on something that I'm really passionate about while being surrounded by intelligent and inspiring people.

Irina Tirosyan
Program Participant, Armenia

Participation in the AI Bootcamp played a crucial role in my career path selection. Before the Bootcamp, I only had abstract knowledge about Artificial Intelligence. After the Bootcamp, I realized that I wanted to continue my career in data science – and thanks to the camp, I have already started.

Artak Kamalyan
Program Participant, Armenia

Education

DS/AI TRAINING PROGRAM FOR TIER C & "UNIT 1991" EDUCATION AND R&D

PROGRAM DESCRIPTION

Problem

AI plays a crucial role in modern security affairs, necessitating greater emphasis on building internal AI capacity through government strategies and defense doctrines. The Armenian Ministry of Defense's recent establishment of specialized scientific and technological detachments for conscript-performed R&D requires a consistent and large supply of trained talent. However, few soldiers are qualified to be conscripted to serve in those specialized detachments, evidencing the need to create a special talent pipeline.

Armenia's mandatory national service also significantly reduces motivation to progress academically both before and after completion of service. The recent abolition of national service deferment sees all conscripts enlisted upon high school graduation, further exacerbating already pre-existing challenges in finding adequately skilled talent. Indeed, this limited talent flow renders serious R&D projects challenging, since they require collaboration within and between scientific and engineering fields, and consequently a large number of tech specialists. The need for a new education and R&D model within the defense sector that sways young recruits to join the specialized unit to further their education would aid to mitigate disruption in basic education.

Solution

February to June 2019 saw an DS/AI training program designed and deployed to equip participants with skills and knowledge on data science applications in intelligence, surveillance, target acquisition and reconnaissance (ISTAR). Data science for the ISTAR program evolved into Unit 1991's Education and R&D program.

In September 2019, FAST, the Ministry of Defense (MoD) and the Hi-Tech Cybersecurity Center signed an MoU that paved the way for the creation of Unit 1991 in August 2020. The MoD established Unit 1991 as the army's high-tech R&D detachment designed to ensure the technological supremacy of Armenian armed forces in any current or potential conflict. It serves as a comprehensive platform for monitoring and building talent flow capacity and deploying R&D projects that generate applicable solutions. FAST designs and implements advanced educational courses on data science and AI for future conscripts, women and Unit 1991 recruits, as well as facilitating R&D projects. This offers recruits advanced training to facilitate defense sector R&D, while increasing the inflow of educated and experienced high-tech personnel into Armenia's civilian workforce upon completion of service.

Results

In 2019, 15 soldiers were trained in DS/AI over 6 months, with opportunities to apply their new skills during and after their national service. An AI workshop on creative idea generation for R&D projects was held with over 25 ideas and project proposals among the workshop deliverables.

January 2020 saw 46 participants completing a competitive selection process to join the **1st pre-army training course of Unit 1991**. Over 6 months, participants studied mathematics and programming for ML, classical ML methods and deep learning, and took part in an R&D Idea Generation workshop. Similar courses were organized in Gyumri and Agarak by FAST partners, Improvis and participants of the "Soldiers as lecturers" program.

The **2nd pre-army training** course since July 2020 is expanding its induction beyond Yerevan to enroll 65 participants from 4 regions. It also includes 8% female participation, offering women a unique opportunity to enter the Armenian defense sector through these detachments. Additionally, in April 2020 an MoU with the American University in Armenia was signed to organize jointly a Training of Trainers in Dilijan and Vanadzor to expand the regional inclusion of the program.

The first conscription personnel for Unit 1991's AI Group, selected by an independent MoD examination committee, is entirely composed of first batch alumni from this program. FAST deployed the **1st in-army advanced training course** in September 2020.

FAST is currently establishing two competitive **AI Labs** - Sis and Masis Gateway - to support Unit 1991 R&D projects and cover the needs of pre-army courses. The labs are designed to provide up to 40 people with high performance computing starting from early January 2021.

The **3rd pre-army** and **2nd in-army advanced training courses** are both planned for launch in January 2021.

Overcoming Challenges

- Limited funding and the need for numerous high-level senior staff in select technological verticals to ensure nationwide rollout of the program may create obstacles at later stages. Furthermore, there continue to be only a small number of specialized personnel for project management of dual-use R&D.
  In the short-term, these challenges are being mitigated by leveraging the potential of the Armenian Diaspora and engaging experts in different formats of collaboration, as well as nurturing senior and managerial staff from Unit 1991 recruits.

CAPACITY

Intellectual | Financial | Network

Timeline
Jan 2019 - Feb 2021

Status
Ongoing

IMPACT INDICATORS

Soldiers directly benefited
15

Training hours conducted
120

Project ideas generated
25+ | of which viable **5**

Future conscripts trained
71 / **65** | of which from regions **31** / **7**
of which females **5**
of which trained by FAST **44** / **65**
of which trained by partners **17**

Capstone projects accomplished
6

Training hours conducted
700 | of which trained by FAST **230** / **220***
of which trained by partners **250**

Tier C
Pre-army training Batch 1
Pre-army training Batch 2

* as of 30 December 2020

GII INDICATORS

SDG TARGETS

Thanks to the “Unit 1991” training course I got a unique chance to receive thorough knowledge and skills in math and programming. The most exciting opportunity that the program unlocked is the perspective of pursuing a highly competitive and thrilling profession. I had rather ambitious expectations of the program which were completely fulfilled.

Aram Hayrapetyan
Participant, Pre-army training, Armenia

Hayk Sargsyan
Participant, Pre-army training, Armenia

The course, in addition to the knowledge required to prepare for the exam, provided an understanding of higher mathematics, which I am studying at university. The most important thing is that the course proved that understanding math for artificial intelligence is not impossible, but achievable, provided we have good mathematical thinking.

Our AI education programs and their scale-up provide academic and industry partners, as well as development entities and donors an opportunity to support the growth of a new generation of AI professionals starting from school age. Here, knowledge partnerships and the contribution of training resources and funding will be required to expand such initiatives up to a national level.

Education

AGRITECH ACCELERATOR

PROGRAM DESCRIPTION

Problem

Armenia's Statistical Committee findings highlight agriculture to be one of the largest contributors to the Armenian economy. Not only did agriculture bring in 14.9% of GDP in 2018, but its absolute value is constantly rising. Despite this, the sector faces numerous challenges locally and globally, including food insecurity, undernourishment, environmental impacts and greenhouse gas emissions.

Moreover, a lack of innovative interventions hampers productivity and hinders technological modernization: 2020 saw the World Bank identify the adoption of innovative technologies and practices by farmers as a "key driver" for increasing agricultural productivity and raising income. Agriculture employed 20% of Armenia's workforce in 2019, 80% of whom live in rural areas. Weak links between entities and individuals working in agriculture and academia, and a lack of entrepreneurial education and research in agriculture act as barriers to starting and scaling up sustainable agri-businesses and thus developing the sector.

Solution

Working with UNDP ImpactAim Venture Accelerator and the Armenian National Agrarian University, FAST has co-designed and implemented an acceleration program to support startups and budding entrepreneurs offering solutions to agricultural challenges in Armenia and beyond. The program aims to create strong links among program participants, academia and industry stakeholders.

The core program lasts 12 weeks and walks participants through a tailor-made entrepreneurial journey. It consists of a series of sessions introducing entrepreneurship, the impact of frontier technologies on agriculture and core startup development, followed by a prototyping stage.

Results

In total, 62 entrepreneurs and 15 startups from 12 countries were selected to participate in the program. A kick-off online webinar took place in June, followed by one month of onboarding sessions, including 8 group sessions, over 20 one-on-one sessions and over 100 submitted deliverables. After the first phase of the program, the core startup development sessions started with 36 entrepreneurs and 10 startups. At this stage, the entrepreneurs got an opportunity to recruit team members. At the core startup development stage, these teams took part in sessions aimed at enhancing different capacities, including finding product market fit, strategy building and mastering the art of sales, among other things. At the final stage of the program, 21 teams pitched their ideas in a live online event. Based on the jury evaluation, 4 teams received grants (2 grants worth 5,000 EUR and 2 grants worth 3,000 USD).

Overcoming Challenges

- A scarcity in growth-stage agricultural startups in Armenia makes recruitment difficult, especially in the light of scale-up objectives.
  To address this in the long run, a concentration of effort will be put into facilitating venture building in agritech through our upcoming initiatives.

- There is a risk that the international teams formed during the training will not be sustained because of the online format, which could see contact being lost after program completion.
  Progress reporting and monitoring, as well as engagement of the teams in future programs can mitigate risks to team sustainability.

FAST cooperates with UNDP ImpactAim Venture Accelerator and is an implementing partner of the ImpactAIM ANAU AgriTech Accelerator program.

CAPACITY

Intellectual **Financial** **Network**

Timeline
Jan 2020 - Jul 2021

Status
Ongoing

IMPACT INDICATORS

Onboarding stage conducted
- for budding entrepreneurs: **62**
- for startups: **15**

Core startup development stage conducted
- for budding entrepreneurs: **34**
- for startups: **13**

Number of graduates
- budding entrepreneurs: **20**
- startups: **8**

Onboarding sessions held: **8**

Core sessions held: **16**

Teams from entrepreneurs formed: **11**

Training hours conducted: **140**

Startups granted with funding: **4**

GII INDICATORS

- **Human Capital & Research**: 2.3.2
- **Business Sophistication**: 5.1.1, 5.1.3, 5.1.4, 5.1.5, 5.2.1
- **Knowledge & Technology Outputs**: 6.2.1, 6.2.2, 6.3.2

SDG TARGETS

- 4 QUALITY EDUCATION — Secondary: 4.4. 4.5.
- 8 DECENT WORK AND ECONOMIC GROWTH — Secondary: 8.5. 8.6.
- 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE — Primary: 9.5. 9.b.
- 17 PARTNERSHIPS FOR THE GOALS — Primary: 17.6.

It was a great opportunity to learn from experienced professionals teaching us about the vital functions of a startup and connecting with like-minded entrepreneurs from different parts of the world utilizing technology to tackle various challenges in agriculture.

Daniel Makobore
Program Participant, Agrosoko, Tanzania

The AgriTech Accelerator program has added to my knowledge I had obtained from other entrepreneurial programs. Particularly, it gave me the opportunity to extensively go through all the phases of preparing a pitch, which is a vital process for a startup. I also got a chance to learn more about “Impact Investing” and how impact investors assess potential for success. The sessions with the experts in different areas were also great, especially when the expert represented the international entrepreneurial community.

Clinton Thomas
Program Participant,
Organify City, Kenya

Vardan Urutyan
Rector, Armenian National Agrarian University, Armenia

The Armenian National Agrarian University and the ImpactAIM ANAU AgriTech Accelerator are very pleased to partner with FAST in achieving our common goals of building the right agritech and biotech ecosystem for Armenia and turning new technologies into the driving force of the education system and the country in general. FAST has been instrumental for all its partners in timely soliciting needed resources and professional support where they are most expected, while carrying out its mission of building a technological future for Armenia and elsewhere.

Education

SCINOVA

PROGRAM DESCRIPTION

Problem

R&D outputs are a key sign of innovation performance, but without commercialization, their real-world benefits, and thus innovation value, are negated. The commercialization of Armenian scientific outputs is currently at a nascent stage with further work and investment needed to augment education around commercialization and support technology transfer. Lessons learned from FAST's programming to date, including its Fellowship, ADVANCE program and entrepreneurial initiatives, has highlighted important challenges for ecosystem players that could be overcome through the provision of a curriculum around how to conduct quality scientific research and commercialize scientific outputs. Indeed, such a curriculum is crucial not only to ensuring that research outcomes translate to innovation outputs, but also to recasting the image of science among Armenian youth from something abstract and academic to something of practical relevance and tangible benefit.

Solution

In 2020, FAST designed a program aimed at creating a curriculum on "Research Design and Science Commercialization". The curriculum will introduce masters and PhD students to the basics of conducting quality research and creating commercial value from scientific inventions. Training for trainers will be made available to academic staff from all academic institutions providing STEM education in the second half of the curriculum's pilot phase. After the curriculum's subsequent integration into the academic program of a partner university, it will be opened up to all interested Armenian universities. This program will also develop a diagnostic tool to evaluate the readiness of universities to engage in the commercialization of research.

This tool aims to identify specific barriers to the industrial application of research outcomes currently experienced by Armenian researchers in order to apply suitable interventions to remove such barriers.

Results

The first phase of this program was launched in November 2020, and it is yet to complete its 7-month journey. Our first major achievement has been the establishment of a strategic partnership with the Armenian National Agrarian University, where a pilot of the course will be conducted, after which ANAU has committed to integrating the curriculum into its academic program of 2021-2022. Curriculum development is now underway in close cooperation with Aston University. A pilot of the resultant course will run from February 2021 with over 25 graduate and PhD students. Other program components are in active planning phases.

Overcoming Challenges

- Challenges in terms of internal support for and receptivity to the integration of a new curriculum among academic staff may arise, which is crucial to that curriculum's sustainability and scale-up within formal education.
  To ensure maximum efficiency, quality and sustainability, FAST with support of ANAU's management has already started identifying and preparing all necessary aspects for the curriculum's smooth integration and the successful continuity of its teaching.

BRITISH COUNCIL
Aston University BIRMINGHAM UK

This program was implemented jointly with Aston University (UK) within the framework of the Creative Spark: Higher Education Enterprise Programme funded by the British Council.

CAPACITY

Intellectual | Financial | Network

Timeline
Nov 2020 - Jul 2021

Status
Ongoing

IMPACT INDICATORS*

Curriculum developed
1

Students benefited from IP training
50

Students trained through the pilot
25

Students benefited from BC's English language training
50

Academic staff trained
12

Training hours conducted
142

* planned

GII INDICATORS

To be assisted

SDG TARGETS

RESEARCH

In order to support the production of globally competitive research output from Armenia, FAST has launched a range of programs to support the local research community and bridge it with the world-leading research community.

In particular, 2018 saw FAST establish its **Fellowship** program with a view to offering financial support to talented students pursuing PhDs in STEM-related fields. We also piloted a program that invited guest researchers to Armenia for mid-term visits, which ultimately lead to the establishment of our **Travel Grant for Collaborative Research** program in 2019. Such programs have seen us establish stronger networks with local scientists, as well as test academic community responses to different approaches. This has led to the establishment of a new framework for research funding – our **ADVANCE STEM Research grant** program – which was launched in spring 2020 and will show its first results in the coming years.

Notwithstanding the above, access to **competitive lab infrastructure** remains a key challenge in Armenia. While FAST's initial strategy envisaged the establishment of several large contemporary lab facilities, a deeper understanding of existing local infrastructure and other capacity factors, saw us shift emphasis towards programming that will consolidate existing labs or build new ones in accordance with the development of Armenia's human capital and funding opportunities in STEM. Inroads are nevertheless currently being made into bringing lab facility access closer to nascent innovation generation through projects such as FAST's **Life Science Incubator** (aimed at securing startup access to professional lab infrastructure) and our Masis and Sis Gateway AI Labs in support of Unit 1991's R&D.

Our programming under this pillar has so far seen us provide funding to **49 researchers**, support to **23 international research collaborations** and **host nearly 100 foreign researchers** in Armenia through a variety of initiatives. In addition, 25 visits to international labs have been conducted and around **70 scientific papers** produced, of which 50 have already been published in international journals.

Below we present some of our programs and insights shared by program beneficiaries.

Research

FELLOWSHIP

PROGRAM DESCRIPTION

Problem

A fundamental challenge for Armenian science is its aging research community and the need to develop a new generation of STEM researchers. The Science Committee estimates that over 40% of all Armenian researchers in 2018 were above retirement age. Meanwhile, 2018 saw overall STEM student numbers down by 33% in 2010. PhD student numbers are declining even more rapidly at a rate of 25-28% a year, with an average 15-17% annual reduction in PhD graduates. Moreover, poor financial remuneration remains a major obstacle for promising Armenian PhD students. This challenge forces many to work in the private sector, often in occupations unrelated to their studies, thus depriving them of full engagement in research activities.

Solution

To enable promising PhD students to concentrate fully on their studies, FAST designed a fellowship program for Armenian citizens and candidates of Armenian descent wishing to conduct doctoral studies in STEM-related fields at leading Armenian universities.

In total, 40 fellowships were to be made available annually, including 5 full fellowships, each worth 7,000 USD a year, and 25 partial fellowships, each worth 3,500 USD a year. In addition, 10 full fellowships each worth 7,000 USD annually were also available to outstanding female candidates.

Results

Independent committees selected 19 PhD students to whom FAST provided financial and institutional support. Of these, 7 grantees were women and 12 were men specializing in physics, biochemistry and computer sciences, among other fields. This saw 6 fellows enroll in PhD studies upon receiving this financial support, and an additional 13 supported to continue their research and studies. Within a year, the program participants had published over 40 scientific papers in international journals and conducted 11 visits to international labs in Europe and the US, connecting them to the global scientific network needed to grow professionally. This program was coordinated with the Armenian State Committee on Science, which runs a similar initiative to incentivize doctoral study. Such coordination helped to prevent double financing by ensuring FAST's sole responsibility for postgraduates under its scheme.

Overcoming Challenges

- There were an insufficient number of qualified STEM PhD students to benefit from the available funding, despite selection standards being calibrated to accommodate as many good candidates as possible.

- Although the program had a positive impact on the further development of the fellows' careers, it became obvious that financial resources alone could not generate the desired outputs. Access to contemporary lab infrastructure remains a crucial challenge, as well.

To tackle these core challenges, future programs will need to focus particularly on increasing STEM PhD students numbers and raising the quality of doctoral programs in Armenia. In the short-term, more opportunities for doctoral students to conduct part of their research and studies in foreign labs should be created. The actual mechanisms for this are yet to be developed.

CAPACITY

Intellectual **Financial** Network

Timeline
Sept 2018 - Aug 2019

Status
Completed

IMPACT INDICATORS

Financial support & mentorship provided
19 PhD students

Papers published in international journals
40+

Theses defended
10 PhD students

Visits to international labs in Europe & US conducted
11 short- & long-term

GII INDICATORS

SDG TARGETS

The huge impact of the Fellowship program on my career is difficult to overestimate, as thanks to it, I had the opportunity to fully focus on my research. As a result, I published 13 research papers in high-ranking international scientific journals. The unique platform for networking and collaboration for young researchers created by FAST was a priceless contribution to the high quality of my research papers.

Sargis Gasparyan
Program Fellow
Researcher, ICRANET - International Center for Relativistic Astrophysics Network, Armenia

FAST Fellowship was a “rescuer” for me when I faced serious challenges around continuing my research due to scarcity of financial resources. Thanks to the program, I was able to fully concentrate on my research. Moreover, I gained self-confidence and belief in what I am doing. I am so thankful to the FAST Fellowship team and those people who spared no effort to give birth to this beautiful program.

Lilit Khachatryan
Program Fellow
PhD Student, Institute of Botany after A. L. Takhtajyan of the National Academy of Sciences, Armenia

The travel grant enhanced the progress of my work and helped me have great success in the prestigious Horizon 2020 Marie Skłodowska Curie Individual Fellowship. Not only did I get a chance to learn from the specialists of my host institute – Instituto de Ciencias de la Vid y del Vino (ICVV) – in Spain, but now we plan to continue our collaboration together with Yerevan State University on a comparative study of Armenian and European grapevine genetic resources at the molecular, genomic and cellular levels.

Anna Nebish
Program Grantee
Lecturer and Researcher, Yerevan State University and Institute of Molecular Biology, National Academy of Sciences, Armenia

Thanks to the FAST Travel grant, I published two research papers in world-class scientific journals with an Armenian team of chemists. Our joint Franco-Armenian project, implemented within the framework of the program, allowed us to create a new class of anti-cancer agents and to propose an alternative concept for the fight against aggressive cancers. At present, we are ready to undertake preclinical trials of our molecules.

Vehary Sakanyan
Program Grantee
Emerita Professor,
University of Nantes, France

Research

TRAVEL GRANT FOR COLLABORATIVE RESEARCH

PROGRAM DESCRIPTION

Problem

The average Armenian GDP expenditure on R&D has been as little as 0.23% over the last decade – less than one-tenth of the OECD average. Limited and inefficiently distributed resources allocated for the development of science result in low research output in the country. The Web of Sciences database suggests that between 2006 and 2018, of all STEM-related articles published by Armenian authors, over 40% received no citations. Moreover, the citation average for Armenian authors was one-fourth times below that of scientific authors on average worldwide. Moreover, most papers that have been cited in other articles are published in co-authorship with foreign researchers (around 60%). Unfortunately, even established international collaborations have limited funding to facilitate mutual visits and joint research activities for Armenian scientists and their international partners, despite their potential to lead to publications in high-impact journals.

Solution

FAST created a travel grant scheme to foster collaborations between Armenian and international STEM researchers. The program was designed to allocate 10 grants for Armenia-based researchers to visit their counterparts, as well as for international researchers to visit Armenia. Grantees were to work on joint scientific projects for a period of up to 3 months and produce joint publications in high-impact journals. These efforts aimed at increasing Armenian research output. Maximum grants were 7,500 USD to cover the costs of international travel, accommodation and daily expenses.

Results

Instead of the planned 10 projects, the independent committee selected 22 researchers within 21 international collaborative research projects in such fields as advanced materials, biotechnology, molecular biology, data science, genetics, neuroscience and physics. Throughout 2019, 14 Armenia-based researchers visited partners in 7 countries at institutions such as Harvard University, University of Cambridge, École Normale Supérieure, University of Tokyo and others. As well as 8 international researchers from the US, UK, France and Israel visited their partners in Armenia from Harvard Medical School, University of Nantes, University of Glasgow and other prestigious institutions. Several collaborations have already resulted in 10 joint international publications. Others are in the process of preparing or submitting the articles, as the established collaborations are long-term.

Overcoming Challenges

- Evaluations revealed that a travel grant is a useful tool to support international collaborative research activities, though it is challenging to assess the direct impact of such grants as they support only a specific part of a long-term international collaboration. Such visits also need to be continuous to sustain a collaboration and make it more efficient, as well as to ensure a sustainable path of professional growth for early-career researchers.
  Comprehensive frameworks to fund and support the full cycle of the research projects need to be structured and scaled to meet these challenges. FAST's ADVANCE STEM Research grant program launched in 2020 is one of such programs.

CAPACITY

Intellectual **Financial** **Network**

Timeline
Feb - Dec 2019

Status
Completed

IMPACT INDICATORS

International research projects funded
21

Researchers funded
22

Researchers impacted
43+

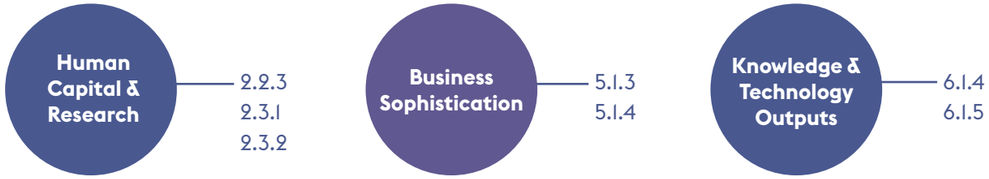
International scientific articles published
11

Articles submitted or in preparation
18

Science talks by international researchers held
7

Institutions affected
33
- of which Armenian **13**
- of which international **20**

GII INDICATORS



SDG TARGETS

Research

ADVANCE STEM RESEARCH GRANT PROGRAM

PROGRAM DESCRIPTION

Problem

A fundamental challenge for Armenian science previously highlighted through the Fellowship and Travel Grant programs is the need to develop a new generation of STEM researchers and augment the country's current low levels of R&D expenditure. If those sections of Armenia's scientific community producing tangible results are to be sustained, well-structured mechanisms for raising a new generation of researchers to preserve and grow that legacy is essential. Ensuring the supply of qualified human capital will likewise aid the country to advance in other fields in which it has a strong potential to generate internationally competitive results.

Solution

In 2020, FAST designed an unprecedented grant scheme for the Armenian scientific community. That scheme aimed to bring top expertise in targeted scientific fields to Armenia by connecting international Principal Investigators (PI) with local scientists. New research teams composed of 3 to 5 scientists are to be formed under the direct supervision of international PIs through the selection of the most qualified researchers, regardless of affiliation.

The research groups will receive comprehensive long-term institutional and financial support. The funding includes salaries for local researchers, lab supporting materials, travel and capacity building opportunities, as well as publication costs. Each grant ranges from between 45,000 to 65,000 USD per year for a project duration of 2 to 4 years.

Results

In 2020, FAST launched the first pilot for this program. Two projects in the fields of biotechnology and machine learning were formed under the leadership of prominent Principal Investigators Garabed Antranikian (Hamburg University of Technology, Germany) and Arnak Dalalyan (ENSAE Paris, France). Since August 2020 the two new teams began their research activities into the topics of "Development of innovative biobased technologies to promote circular economy" and "Statistical analysis of machine learning algorithms (SAM-lab)". These projects are planned to be supported by FAST over 4 years. Efforts are also underway to develop new projects focusing on AI, robotics and life sciences.

Overcoming Challenges

- The low number of active researchers qualified for the program remains one of the biggest challenges. Moreover, many researchers have high workloads due to multiple affiliations and engagements in academia. In other cases, they have to combine their academic activities with a job in the industry, which offers highly competitive salaries, especially to specialists in such fields as machine learning.
  Additional incentives must be created to engage active researchers, while a heavy focus should be placed on creating a pathway for young talent to choose research as a career. Actual mechanisms are yet to be developed.

- Creating cross-institutional and cross-sectorial ties by bringing together researchers from different institutions and research groups under a competitive research project is challenging in the culturally cloistered and conservative environment in which Armenian research groups operate.
  The involvement of an international PI significantly helps to mitigate this challenge. A researcher's motivation to participate in the program is predominantly determined by the opportunity to work under the PI's supervision, encouraging researchers to step out of their usual working environments. Only if deeper systematic changes are undertaken, can this deep rooted issue be truly overcome, however.

CAPACITY

Intellectual | Financial | Network

Timeline
2020 - 2024

Status
Ongoing

IMPACT INDICATORS*

International PIs engaged
2

Local researchers funded
6

Trained & traveled abroad
10

Trainings conducted by PIs for local researchers
16

Publications in the high-impact factor journals
⩾8

Months spent by PIs in Armenia
16

Planned
Achieved

* for Batch I only

GII INDICATORS

To be assisted

SDG TARGETS

I am very happy to be selected for the ADVANCE program, as both the topic and the opportunity to work under Professor Antranikian's supervision contributes greatly to my professional growth. Our research project envisages the development of a circular bioeconomy which is a starting point in this field for Armenia. I am convinced that due to the group work and collaborations, significant results will be achieved both in terms of raising the qualification of specialists and the development of new technologies and their further applicability.

Ani Paloyan
Program Grantee
Senior Researcher, "Armbiotechnology" Scientific and Production Center, National Academy of Sciences, Armenia

The ADVANCE program offers donors, academics and corporate sponsors an opportunity to drive competitive research and foster development of advanced research centers in chosen scientific fields.

Research

COMPETITIVE LAB INFRASTRUCTURE

Competitive laboratory infrastructure is crucial to achieving market-leading innovative STEM output. As such, enhancing Armenia's lab infrastructure forms an integral part of FAST's work on its key priority areas. Deeper insight into Armenia's existing lab infrastructure over the last years has highlighted that existing research activities can be advanced further with the modernization and consolidation of current lab facilities. In specific areas of need, new contemporary labs should also be created. Moreover, the human capital (technicians and researchers) needed to maintain and use labs in a number of fields requires augmentation to ensure efficient resource use in the development of new infrastructure.

As such, FAST's work on alleviating challenges of lab accesshas focused on identifying areas for infrastructure development where absorption capacity is guaranteed. We have thus started to develop and integrate specific types of lab facilities directly into the innovation ecosystem to offer those with competitive science-backed solutions the facilities to explore their ideas in a professional laboratory setting. This infrastructure development is being conducted alongside efforts through other programs to enhance the number of researchers able to use and maintain such facilities. This gradual approach to scaling-up Armenia's lab infrastructure and the use of such facilities is intended to feed into our larger-scale Adaptive Innovation Campus – a mega-project designed to stimulate the kind of accelerated growth capable of triggering a technological leapfrog.

FAST is currently developing two projects in this arena: its Life Science Incubator and AI Labs intended to operate within the framework of its Unit 1991 collaboration with the Ministry of Defense.

LIFE SCIENCE INCUBATOR

The Armenian Life Sciences sector is currently at a stage of development that has the potential to allow for notable startup generation. It benefits from existing human capital (PhD students, researchers and other experts), as well as accessible startup venture funding to support transition from research to commercialization through initiatives like STAN, Granatus Ventures, SmartGate VC, HIVE Ventures and the Business Angel Network of Armenia. However, accessible and centralized wet lab infrastructure to test innovative ideas remains an obstacle. A life sciences incubator to facilitate startup growth and evolution into biotech companies would help to overcome the challenges posed by underdeveloped lab infrastructure and an absence of shared core facilities.

The Life Science Incubator (LSI) is a program ultimately designed to leverage and catalyze Armenia's life science/ biotech potential. It entails the development of a wet laboratory for the analysis and testing of different scientific hypotheses (proof of concept) that may be generated from pre-seed and early-stage startups. The incubator will provide startups with access to laboratory instruments and expertise, which are typically barriers to entry for startups with limited funding. The LSI will also house mentors, advisors and consultants to facilitate direct access to expert guidance focused on a startup's area of need. Additionally, the LSI will provide practical laboratory training for university students, exposing them to the biotech industry outside academia. FAST's various research and entrepreneurial initiatives, including the AgriTech Accelerator, SciNova, InVent and ASCENT, as well as its ADVANCE STEM Research Grant program, will provide a steady flow of human capital to maintain and utilize this new facility as it opens its doors to the wider ecosystem of innovation users.

FAST has entered into collaboration with both the Armenian National Agrarian University, which has agreed to house the 400m² LSI, and the Armenian Government, who will be funding the renovation of the space. Meanwhile, FAST itself is responsible for producing and implementing the LSI concept, steering its management and securing the necessary laboratory equipment. The current projected launch date for the incubator is estimated for September 2021, which will see the completion of the first phase of this project. Having thus established the facilities for basic biological experimentation, the intention is to expand this project in the years to come to the scale of Armenia's burgeoning life science innovation.

AI LABS

AI is of crucial strategic importance to Armenia's future, including its national security. This renders the development of sophisticated AI experimentation facilities a key priority in seeking to augment the country's innovation capacity. Not only would such infrastructure enable defense sector trainees under programs like Unit 1991 to acquire and apply their newfound AI knowledge in an experimental setting conducive to hands-on skills development, but it will also provide a fertile environment for further innovative AI research and development.

The significance of competitive lab infrastructure to AI advancement saw two AI Labs - Sis and Masis Gateway - fundraised for through the generous efforts of Gateway Industry in the autumn of 2020. These labs are currently being established by FAST to support Unit 1991's educational and R&D initiatives, being designed to provide high performance computing for up to 40 people. Their creation is an important strategic benchmark for Armenia's AI development and marks a unique contribution to defense sector capacity in matching the establishment of in-house expertise with access to state-of-the-art equipment to facilitate accelerated work on AI.

It is intended that the **Masis Gateway AI Lab** will be provided to Unit 1991's AI Group for use in various R&D projects undertaken by the detachment. The lab will provide the necessary computational resources and technological environment for the successful implementation of projects. Part of the lab was already established in October 2020 and the entire facility is expected to become fully functional in early 2021.

The **Sis Gateway AI Lab** will be hosted at FAST's Creative Campus and will cover Unit 1991's needs for pre-army education and training. Students will use the lab's resources to deploy their computation-intensive capstone projects successfully, train their machine learning prototype models and undertake other aspects of practical AI training.

Projects currently within the scope of FAST's Competitive Lab Infrastructure program offer donors, academic institutions, corporate sponsors and investors a range of opportunities for involvement in creating enhanced lab facilities for Armenia's life science and/or AI sectors. These include the ability to contribute to emergent R&D through the donation of equipment or funding, as well as access to investment-worthy startups.

COMMERCIALIZATION

Recognizing the critical need to boost scientific commercialization in Armenia, we have placed a heavy focus on creating programs that will help build science-intensive innovation and also ensure pre-seed funding for companies created through this pipeline.

February 2018 saw FAST initiate Armenia's first science-intensive venture builder through its **Advance Solutions Center's** (ASCENT) first track in AI. Having rapidly developed into a 3-track program, this initiative has since spun off to become a separate commercial entity, ensuring its independent long-term sustainability. In the same year we also established Armenia's **first Angels Network** (referred to as **STAN**), going on to establish our ongoing **InVent** program in early 2020. This latter program drew on our learnings from working with both startups and through our ASCENT program. We are now working to establish two venture capital funds for ASCENT and InVent to further support the development of science-backed ventures in Armenia.

Well over 200 startups have benefited from our programs over the last three years. Among them 11 startups received direct funding, while 26 startup teams were created from scratch. Up to 100 startups received a 2 to 6 month mentorship and coaching program, as well as access to coworking space at FAST's Creative Campus.

FAST has also become a part of **WIPO's Technology & Innovation Support Centers Network**, providing innovators in Armenia with access to patent, scientific and technical databases, assistance in using databases and advice on IP management. However, as the process of technology transfer and patent acquisition is currently a major weakness in Armenia, FAST's main input has been the training of local innovators in IP management. This has included training of FAST's own staff through various WIPO distance learning programs.

To support commercialization FAST has also supported several **hackathons and entrepreneurial events**. We hosted the SpaceApps Challenge in 2018 and provided awards to winners in 2018 and 2019. Furthermore, since 2018 we have been a partner of the Sevan Startup Summit. This is an annual informal startup event involving over 300 startups, 13,000 participants, over 50 VCs and investors and over 180 speakers and mentors between 2018 and 2019 alone. Here, FAST has provided startups an opportunity to access funding by organizing pitches and meetups with STAN's angel investors. In 2018 FAST awarded first prize at the Summit to deeptech startup, SuperAnnotate AI.

I'm thrilled to be a small part of the amazing efforts and initiatives that FAST is engaged in to encourage and support entrepreneurship in Armenia. Promising talent coupled with great startup education makes me very excited for Armenia's future.

Marvin Liao
Former Partner, 500 Startups,
United States

Commercialization

SCIENCE AND TECHNOLOGY ANGELS NETWORK

PROGRAM DESCRIPTION

Problem

While the ICT sector had seen accelerating startup growth by 2017 (over 26% on average annually over the last decade) there were still only a few grant opportunities to support such startups, with no Angel groups and a scarcity of state aid. Raising foreign investment capital was also challenging at this time due to Armenia's low attractiveness for venture capital and private equity (Armenia ranked 77th of 125 nations on the Venture Capital and Private Equity Country Attractiveness Index).

Solution

In early 2018, FAST established the Science and Technology Angels Network to help fill Armenia's gap in seed-stage investments. STAN serves as a platform that unites a group of prominent Armenian professionals from all over the globe to invest in Armenian pre-seed and seed-stage startups engaged in science and technology innovation.

Along with providing access to risk capital, STAN also possesses a vast expertise that can be leveraged to support companies through strategic advice, mentorship, introductions and connections capable of facilitating their further development. Each member of the network commits to invest 10,000 USD annually during the first 3 years and 20,000 USD thereafter. Three to four Angel investment pitches are organized annually for startups.

Results

Originally formed by 18 founding members, STAN has now expanded to encompass 25 Angels from various industries committing 620,000 USD in total since its establishment. In all, 7 investment pitch events have been held, and around 90 startups have pitched their ideas. The network has made 295,000 USD in investments in 5 startups. STAN holds membership in European Business Angels Network since 2018.

Overcoming Challenges

- Armenian legislation is not yet optimized to support startups. This is because it still lacks regulations for convertible securities, option pools, vesting schedules and other legal instruments crucial to establishing successful ventures. As such, many startups register in jurisdictions like Delaware to access such tools.
  To mitigate this challenge in the short-term, FAST has conducted public policy analysis and built several tools, such as investment agreement and shareholder agreement templates, to help the startup community establish entities in Armenia. However, the official adoption of such tools on the national level should still be facilitated, as it would significantly boost the startup ecosystem's development.

- There are few Armenian startups that produce deeptech or science-focused solutions.
  To mitigate this over the long-term, FAST has put considerable effort into expanding venture-building programs to ensure a sustainable pipeline of competitive startups.

- In addition, many Armenian startups currently pitch valuations that are higher than their actual stage of maturity. This highlights a disconnect between startup expectations and investor perspectives on valuation.
  To reduce this disparity in perspectives, FAST has used dedicated sessions and programs to educate both startups and investors on such valuation issues. The use of Discount Rates instead of Valuation Caps in investment agreements may be another means of overcoming this discrepancy.

CAPACITY

Intellectual | Financial | Network

Timeline
Since Feb 2018

Status
Ongoing

IMPACT INDICATORS

Angels involved
25 | of which females **3**

Amount of investments made
295,000 USD

Countries represented
9

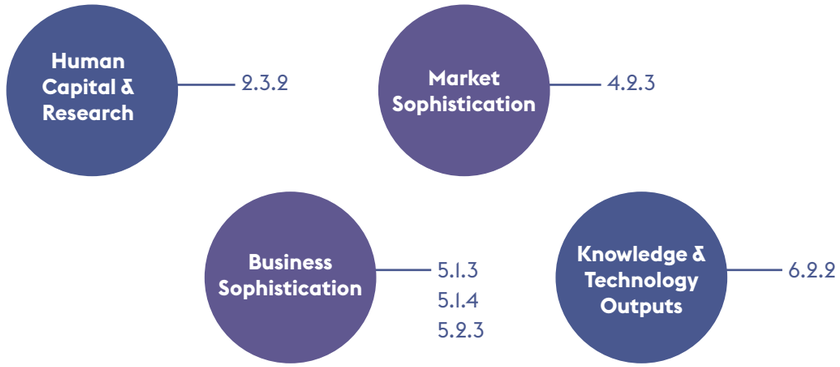
Investments made
5

Angel funds committed
620,000 USD

Pitching sessions held
7

Startups pitched
90

GII INDICATORS



SDG TARGETS

Ruben Arutyunyan

Co-Founder, Co-Chair, STAN
Founder and President, HENDERSON Russia Group, Russia

FAST has managed to create a unique ecosystem for the development of science and technology in Armenia in a short time. Among its programs is the STAN business angel community – a platform for supporting and developing startups in the country. I had a dream of creating in Armenia the strongest and the most professional community of business angels, to support talented and motivated entrepreneurs from Armenia and their startups in their development and international expansion.

We all understand how small the Armenian market is, and it is almost impossible to create a large and successful business exclusively by working in the local market. STAN is about smart money. Our key advantage is that STAN is composed of several dozen successful entrepreneurs and professionals from Russia, Europe and America. Our angels have expertise in most major markets in the world, and we are able not only to finance a startup, but also provide young entrepreneurs with advice on how to develop innovative projects that can make Armenia and our world a better place.

Igor Khalatian

Co-Founder, Co-Chair, STAN
Vice President of Development, Oracle, United States

Today there is sometimes the impression that you have to go to the US, Europe or other countries to be very successful. I would like to help to create such an ecosystem in Armenia to put the country on the map as a country where you go to become highly successful. I believe that with tremendous IT talent and large Diaspora connections Armenia has all the ingredients it needs to become such a destination.

STAN offers individual investors access to pre-seed and seed-stage investment opportunities with a growing focus on AI as a platform technology. STAN also provides a platform through which idea-stage funding can be provided to high-risk, high-return deeptech projects, as well as offering an opportunity for special impact investment in women-led idea-stage startups to leverage women's entrepreneurial potential in Armenia.

STAN MEMBERS

Founding Angels

Igor Khalatian
Co-Chair, STAN
Vice President of Development, Oracle, United States

Armen Orujyan
Founding CEO, Foundation for Armenian Science and Technology, United States

Artur Alaverdyan
Owner and Chairman, ProfHolod, Armenia

Aram Manukyan
Co-Founder and Deputy Director, MIZHEN, Russia

Gor Nakhapetyan
Professor, Moscow School of Management SKOLKOVO, Russia

Ruben Vardanyan
Founder, RVVZ Foundation, Russia

Areg Zakoyan
CEO, ProjectUP, Cyprus

Ruben Arutyunyan
Co-Chair, STAN
Founder and President, HENDERSON Russia Group, Russia

Noubar Afeyan
Founder and CEO, Flagship Pioneering, United States

Igor Avanesyan
CEO, Center Capital ZAO, Russia

Anushavan Simonyan
Head of Investment Banking Department, UBS Bank in Russia and CIS, United Kingdom

Ruben Vardanyan
Founder and CEO, Joomag, United States

Vahan Vardanian
Venture Partner, Buran Venture Capital, Russia

Artur Tovmasyan
Founder and CEO, International Food Technologies, United Kingdom

Angels

Sargis Badalyan
Founder, SIMS-2, Armenia

Mariana Grigoryan
Founder, Vermotus, Hong Kong

Astghik Khachatryan
Director Leveraged Finance, Bank of America Merrill Lynch, France

Gevork Sarkisian
Founder and President, Innova Partners, Russia

Gurgen Martikyan
Co-Founder and Executive Partner, NetGenix, United States

Lilit Nazaryan
Director, Credit Suisse, Switzerland

Rem Darbinyan
Founder and CEO, Smartclick.AI, United States

Vahag Karayan
Head of Professional Services, Entertainment Partners, United States

Sascha Gharibyan
Director, BAAM Venture Capital, Germany

Sassoon Kosian
Corporate Vice President, New York Life Insurance Company, United States

Stephan Reckie
Co-Founder and CEO, Angelus Funding, United States

Commercialization

ADVANCED SOLUTIONS CENTER

PROGRAM DESCRIPTION

Problem

Armenia's high-tech (mostly IT) sector predominantly has very low levels of R&D activity. While indigenous R&D is increasing slightly, there are only a handful of Armenian science-backed or deeptech startups that develop their own tech products based on in-house R&D. By contrast, most IT companies use existing providers for services and outsourcing. Moreover, a lack of science-intensive venture builders needed to accelerate the process of science-intensive startup creation hinders the generation of companies capable of achieving the higher valuation status needed to compete at the same level as their outsource-oriented counterparts. Recent studies suggest that venture builder-backed companies have a 60% likelihood of providing for a successful exit compared to just a 5-20% likelihood among venture capital-backed startups.

Solution

FAST designed the multifunctional ASCENT platform, which develops science-intensive ventures with a high potential to become internationally competitive deeptech companies. ASCENT has 3 tracks: Artificial Intelligence, Computational Behavioral Research and Life Sciences. It uses its innovation model and a stage-gate process to evolve ideas from venture hypotheses through prototype companies to new companies and eventually spinoff ventures. The innovation model is co-designed with Flagship Pioneering, a leading venture-building company based in Boston which has generated more than 100 companies since 2013. An integral part of the solution is a yet-to-be-established venture capital fund attached to ASCENT to help further fuel company growth.

Results

The **AI track** was launched in February 2019. 150 venture hypotheses (VH) were generated at the exploration phase, of which 8 VHs have been deeply explored. The track's first Prototype Company (ProtoCo), which creates AI algorithms for drug discovery, was subsequently launched in 2020. Proprietary algorithms have been designed for generating anti-cancer and COVID-19 drugs. In silico performance of newly developed molecules has surpassed that of other existing candidates, and AI-generated molecules will be synthesized and studied in early 2021.

The **Life Sciences track** saw a team of researchers assembled and complete a 2-month training at Flagship Pioneering in Boston (US) in September 2019. Over 100 VHs have been generated by the team, of which 3 were deeply explored and developed. Of these, 2 have been turned into full ProtoCo candidates and 1 VH is currently at the pre-ProtoCo stage.

In November 2019, the **Computational Behavioral Research track** was formed, generating over 50 VHs, of which 4 have been turned into full ProtoCo candidates. One of these candidates, which works on the synthesis of AI applications and behavioral models for more accurate loan scoring in the banking sector, entered the actual ProtoCo phase in late 2020.

By autumn 2020, ASCENT's model for science-intensive venture building, having been tried and tested, reached maturity and became ripe for spin off as a separate for-profit entity. Moreover, ASCENT's first AI track ProtoCo has now received funding from investors and formally incorporated as "**DeNovo**" company, becoming the first startup to spin off from ASCENT.

Overcoming Challenges

- The absence of dedicated venture capital attached to ASCENT (and usually available to venture builders), creates budgetary constraints for the ProtoCo stage, hindering the scale-up of VHs into companies.
  Much effort is being put into creating such venture capital as quickly as possible.

- A scarcity of high-level data scientists and biotech scientist-entrepreneurs, and few specialized interdisciplinary researchers, slows the company development process down.
  Short-term, this deficit is being mitigated through intensive training courses organized by FAST and potential recruitment of experts from neighboring countries. In the long run, however, comprehensive educational initiatives should be shaped.

- Underdeveloped laboratory infrastructure and an absence of shared core facilities in Armenia creates greater challenges for ASCENT's Life Sciences track.
  To address the need for laboratory space, FAST is actively establishing a Life Science Incubator that will serve ASCENT and local startups to advance commercialization in this scientific sphere.

CAPACITY

Intellectual **Financial** **Network**

Timeline
Since Feb 2019

Status
Ongoing

IMPACT INDICATORS

Scientists/Data Scientists trained
14 of which in Armenia
11
of which in USA
3

Training hours conducted
440 of which in Armenia
40
of which in US
400

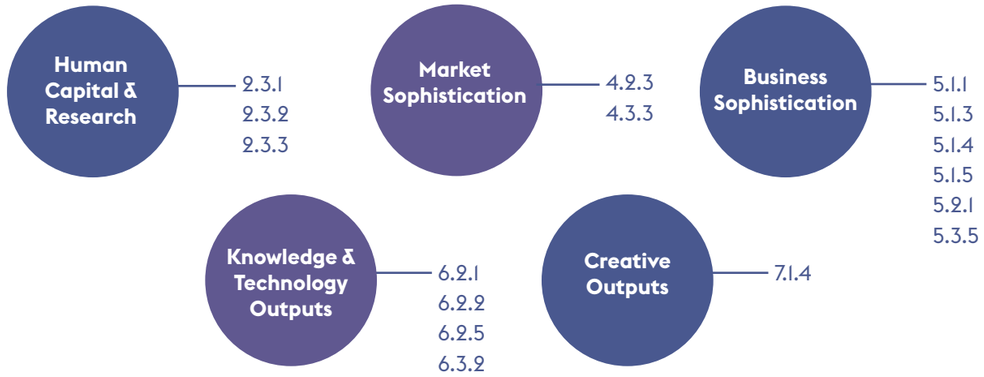
VHs explored
140 of which medium level
9
of which deep
8 / **3** / **4**

ProtoCo created
1 / **1**

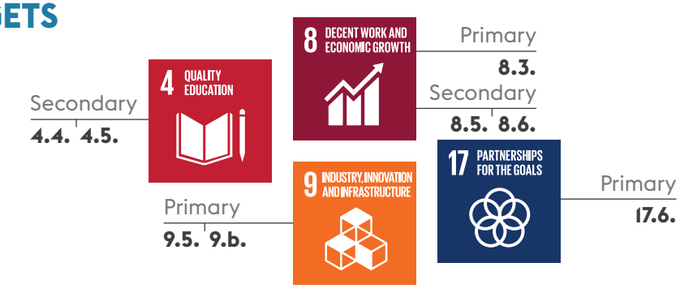
Pre-ProtoCos completed
1 / **2**

AI
Life Science
Computational Behavioral Research

GII INDICATORS



SDG TARGETS



Andre Serobian
Senior Research Associate,
Life Sciences Track, ASCENT

The ASCENT Life Sciences team was privileged to attend Flagship Pioneering in Boston for training in the development of innovative biotechnology. Having a traditional academic experience and background, we were exposed to a new way of thinking when approaching biotech solutions with a commercialization mindset. Learning an alternative approach has provided new insight into the world of biotech and has proved to be both a steep and critically valuable learning curve. The learnings from Boston will be essential to the succession plan of FAST's effort in developing leading technology in Armenia.

Commercialization

INVENT

PROGRAM DESCRIPTION

Problem

FAST's experience with entrepreneurial programs and STAN pitches, as well as its research on Armenia's venture industry, highlight that Armenia's existing entrepreneurial landscape lacks the capacity and scale to accommodate even the limited available funding offered by venture funds and angel networks. This is more acute for science-backed ventures where there are only a few startups offering deeptech solutions and limited availability of venture funding.

Over 3 years of STAN operations, around 78 startups have pitched for a total committed sum of 620,000 USD, yet 85% of this sum has remained uninvested. Moreover, while ASCENT is generating many promising ideas, it only has the capacity to concentrate on breakthrough ideas with significant market potential. Thus, many bold ideas remain unutilized. These experiences show that increasing a deal flow for investors in the Armenian startup ecosystem requires a model for enabling startup creation.

Solution

In 2020 FAST designed a pioneering venture-building program to utilize ASCENT's filtered ideas, and challenges collected from industry and government, to generate startup companies using an exploration methodology tailored to matching prevailing needs and opportunities. The InVent program runs over 20 weeks and walks serial entrepreneurs, researchers and industry professionals through the startup journey from idea generation and team formation, to minimum viable product (MVP) development and fundraising. Throughout the program, FAST provides full institutional and financial support to the participants. The best teams receive idea-stage investment and get a chance to raise 50,000-100,000 USD pre-seed stage investment from STAN. An internal VC fund will also fuel the growth of these companies.

Results

Two tracks were formed during the first intake batch for this program: an AI track with 39 entrepreneurs and an Environmental track with 12 entrepreneurs. Around 30 startup development sessions and over 150 hours of one-on-one sessions were organized to ensure the establishment and growth of the startups. Over 5 months, 13 startup teams were created, of which 8 pitched for prototype funding and 4 secured 5,000 USD in investment each for developing a prototype.

One of these four (Jarvis) was chosen by the Armenian Ministry of High-Tech Industry to take part in an entrepreneurial program organized by Draper University, while a further two (Joong and DigiEmotions) received conditional offers for a 10 million AMD grant. Another team, LoopEx, won the "Digital Technology" category among Armenian participants during the Big Idea Challenge organized by the British Council.

A second program batch focused on AI will launch in February 2021.

Overcoming Challenges

- Being founded on ASCENT generated ideas, this program risks being compromised if these ideas are not generated in sufficient quantity. Moreover, while some ideas have vast potential, they may need larger investments to become a prototype.
  These factors are currently being mitigated through the creation of partnerships with private sector actors capable of supplying the program with market-driven ideas and challenges.

- Access to funding for successful startup teams can be challenging as there is no internal venture capital yet attached to the program.
  Scale-up plans for the program mean that the establishment of such venture capital is now necessarily underway.

This program was implemented jointly with Aston University (UK) within the framework of the Creative Spark: Higher Education Enterprise Programme funded by the British Council.

CAPACITY

Intellectual | Financial | Network

Timeline
Jan - Sept 2020

Status
Completed

IMPACT INDICATORS

Entrepreneurs recruited
39 / **12**

Teams formed
9 / **4**

Training hours conducted
44

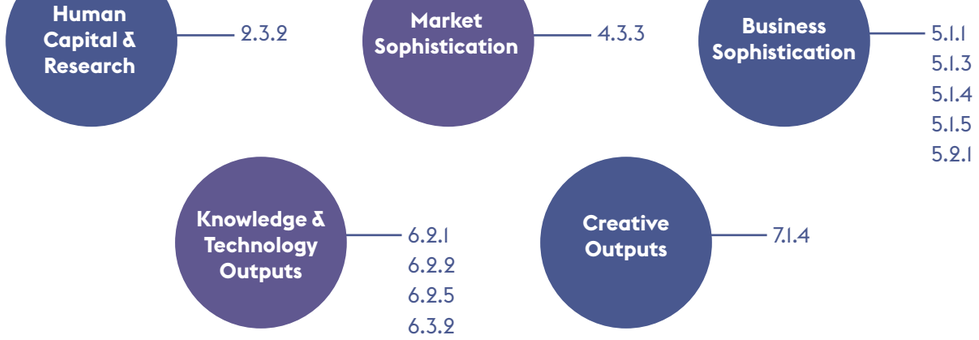
Teams pitched for funding
8

Teams granted with funding
4 / **0**

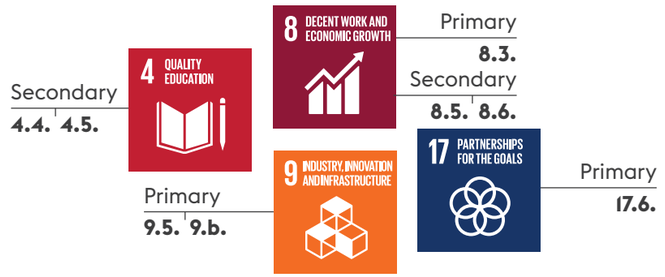
Funding provided to teams
20,000 USD

AI
Environmental

GII INDICATORS



SDG TARGETS



Irina Minasyan
Co-Founder, Joong, Armenia

Participation in the InVent program was a priceless transformation for me as an entrepreneur. Thanks to the program I learned to take risks and constantly challenge myself to get out of my comfort zone. As a result of the program, we formed a strong team, developed our idea from scratch, got funding, and have already taken the first big steps in our startup journey. The opportunity to reinforce and lead the success of a unique startup with people who share the same vision and values is such a powerful feeling!

We have found the partnership with FAST very valuable. A cornerstone of our philosophy as an academic institution is to build partnerships with like-minded institutions globally. We have extensive collaborative arrangement in place throughout the world, particularly East Asia and China, but Western Asia we see as an underserved region from an academic perspective. Our collaboration with FAST is providing the opportunity to build partnerships in the region, particularly in the area of technology and entrepreneurship where there is a history of expertise and skill development in Armenia. In the immediate term our focus is on collaborative research projects with the aim of facilitating spin off companies and knowledge transfer with industry.

Geoff Parkes
Senior Teaching Fellow and Principal Fellow,
UK Higher Education Academy, Aston University, United Kingdom

FAST's InVent program offers companies a chance to source innovative solutions to corporate challenges and offers investors access to investment-worthy tech startups. It also offers to companies an opportunity to boost their visibility among entrepreneurial circles and showcase themselves as innovation catalysts.

Commercialization

NERUZH DIASPORA STARTUP PROGRAM

PROGRAM INITIATION
NERUZH 2018

The Neruzh Diaspora Startup Program was established at the initiative of the Ministry of Diaspora and co-designed by FAST in 2018. The program promotes the inflow of innovative, capable and scalable tech startups from within the Armenian Diaspora to enrich the local startup landscape. It seeks to invest in their advancement and growth within Armenia and to serve as a gateway for deploying and scaling-up impactful Armenian technologies and business models throughout world markets. In doing so, it leverages Armenia's significant Diaspora presence and deep connections in the leading global tech hubs. The program offers a 5-day intensive startup development session involving coaches and mentors from all over the world, interactive training, individual coaching, networking, collaboration opportunities and opportunities for exposure and pitching. Participating startups not only acquire knowledge about the benefits of doing business in Armenia but are also given a chance to compete for grants up to 30,000 USD to grow their ventures.

Neruzh 2018 has enjoyed broad support from entities such as ImpactHub Yerevan, Business Support Office - EBRD, UNDP ImpactAim VA, the Gulbenkian Foundation, Armenian Caritas, and the Russian-Armenian University. The program has supported 49 Diaspora and 16 local startups from 20 countries around the world. In total, it has now gathered around 210 participants, including 129 entrepreneurs, as well as 27 speakers and coaches. The program saw participants pitch during the first program batch in 2018, with 12 winning teams selected to receive different awards and grants provided by the Ministry and its partners. The top 3 startups received Ministry awarded grants of 30,000 USD each, as well as partner support to grow their businesses in Armenia. FAST's strong Diaspora connections so it selected from the outset, and remain, the Government's core implementing partner for this program, also supporting grant winners to establish their ventures in Armenia through follow-up programs implemented for winning teams.

PROGRAM CONTINUATION
NERUZH 2019

In 2019, a global restructuring of Armenia's Ministries saw the program transferred to the leadership of the Ministry of High-Tech Industry with co-organization from the Office of the High Commissioner on Diaspora. That year, the Business Angels Network of Armenia joined FAST as co-organizers and content partners, while the IDeA Foundation, UWC Dilijan College and Orion Worldwide Innovation also became implementing partners.

Neruzh 2019 hosted 47 startups from 19 countries around the world. In total, the program has now gathered around 230 participants, including 80 entrepreneurs and 106 speakers, coaches and mentors. During a final pitching session, 6 teams from 2 startup stage categories were awarded grants totaling 135,000 USD along with other awards from partners.

While this program was formerly a joint program between the Ministry of Diaspora and FAST, it has evolved to become wholly owned by the Ministry of High-Tech Industry in collaboration with the High Commissioner on Diaspora. For FAST this transfer of ownership represents the optimal sustainability outcome for any co-run project.

Armenia should no longer be perceived by its Diaspora as a mere emotional territory, with its Mount Ararat and its rich past. Armenia is the present and the future. We have a modern, attractive and developing state, where you can come, live, create, get rich, enrich others and enjoy life. This was the central philosophy underpinning the foundation of the Neruzh program.

I have been asked to express why as the author of Neruzh, I chose FAST to become the Ministry of Diaspora's main partner in this initiative. The history behind this is slightly different. I am not the sole author of Neruzh. FAST is as much the author of Neruzh as I am. Neruzh was born during active discussions on the engagement of young Diaspora Armenians in the life of their homeland. We were discussing how the homeland can assist in this engagement. This is how Neruzh came out as a product of the mutual exchange of ideas and concepts among me, as Minister of Diaspora, FAST, the IDeA Foundation and Impact Hub.

Mkhitar Hayrapetyan
Former Minister, Ministry of Diaspora
Current Chair, Standing Committee on Science, Education, Culture, Diaspora, Youth and Sport, National Assembly, Armenia

Neruzh had an unbelievable impact on my expertise as an entrepreneur. I had a chance to learn so much from experts in the field, mentors and other founders. It was my first public pitching experience, which I will never forget with so many correct and important learnings. But, what is more important, the connections that we all got in Armenia and Diaspora. I think that it was the greatest impact one could have living abroad. In a week, I was able to connect to nearly every industry that touches the Armenian startup ecosystem. I have seen how the ecosystem is developing, what the challenges are and the great opportunities. Neruzh made me feel part of the Armenian ecosystem, not the German. Now, I am putting all of my effort into creating something in Armenia instead of anywhere else.

Haik Ter-Grigoryan
Product Owner, Mixed Reality Technologies, Germany

ECOSYSTEM LEVEL

A number of FAST programs represent interventions at the cross-pillar whole ecosystem level. Over the reporting period 5 programs were conceived at this level, though by the end of the reporting period 3 had been suspended due to COVID-19, one reshaped and one put on hold until the necessary conditions are ripe for its full implementation.

POLICY AND LEGAL DISCUSSION PROGRAM

In 2019, FAST launched its Policy and Legal Discussion Program (PLDP) as a pilot aimed at helping to shape the policy environment affecting science, technology and innovation. This pilot saw FAST complement government efforts in this field by attempting to generate robust industrial dialogue and hold discussions among legal and policy professionals on legal and policy grey spaces with a view to identifying obstacles, devising action plans and generating a series of reform recommendations. These discussions sought to foster diverse participation among key stakeholders to ensure maximal efficacy and buy-in on matters of reform. As such, participants included representatives from relevant government branches, the Central Bank, law firms and local startups, as well investment and finance specialists.

Discussions have focused primarily upon challenges for commercialization. For example, they included discussions on policy reform in the field of debt financing instruments for the startup economy (e.g. SAFEs and convertible notes), as well as on possible tax incentives to boost innovation. Discussions were also carried out in the form of open startup meet-up sessions, aimed at introducing Armenia's startup community to the concept of debt financing and how it can help early-stage startups to grow their business.

In spring 2020, this program was suspended as COVID-19 rendered both undertaking such discussions and follow-up liaison with the Government on the need for policy reform no longer feasible.

THE INNOVATION DISTRICT AND THE ADAPTIVE INNOVATION CAMPUS

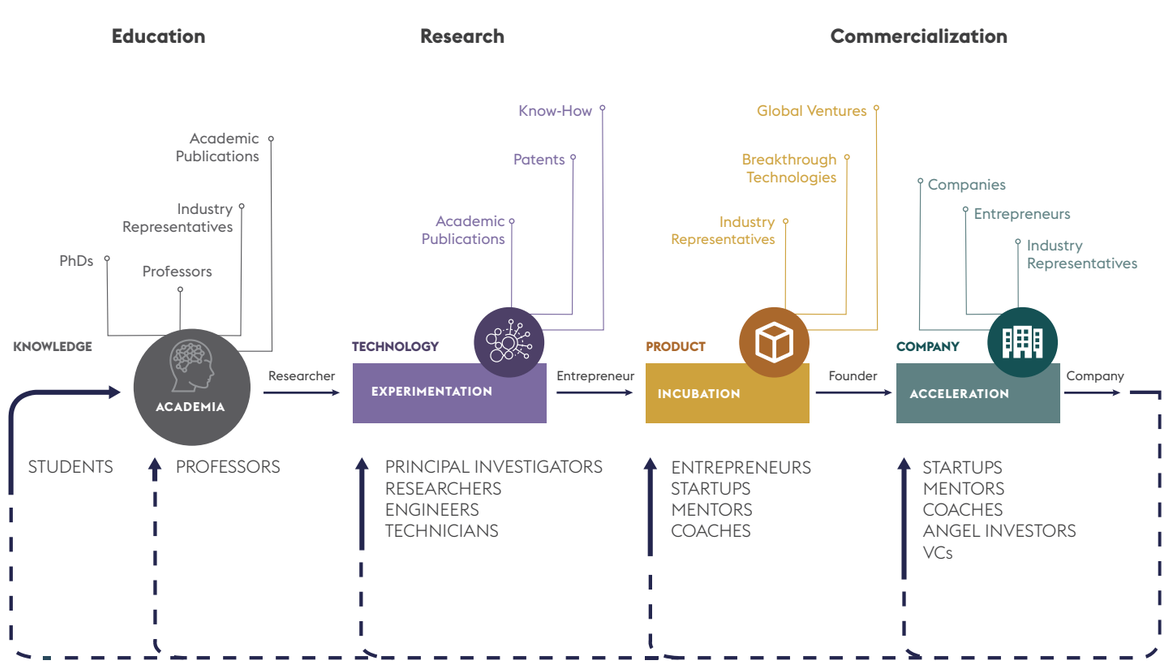
No single entity can drive innovation alone. Innovation is rather a story of co-creation, collaboration and exchange of ideas among many contributors over the years and even decades. This interplay among vast networks of researchers, engineers, investors and precursor technologies creates an innovation ecosystem where theories and ideas lead to experimentation, which generate new technologies that can be scaled into products and commercial ventures.

In light of this, innovation is becoming progressively defined by spaces that allow people to come together to share ideas and work collaboratively on creative solutions to modern problems. This understanding has led FAST to propose the development of an Innovation District: an all-encompassing sustainable environment where people live, learn, work and create.

Armenia's **Innovation District** would serve as a venue for co-creation and open innovation, prototyping, regulatory and policy innovations to meet national priorities and goals, and contributing to the country's socio-economic development. In doing so, it would offer globally competitive education, research and innovation infrastructure, combining R&D growth, open innovation, innovation sandboxing, urban renewal and smart and green infrastructure. Having been designed to boost the country's global innovation standing, it will also form a landing pad for regional and international public and private stakeholders. To this end, the District would be driven by an Adaptive Innovation Campus (AIC). As the District's powerhouse the AIC will be supported by ancillary facilities housed in a carbon-neutral green environment and powered by clean energy.

The **Adaptive Innovation Campus** is intended to provide a base for inspirational discoveries, scientific breakthroughs and transformative technological advances. As such, it would act as a collaboration hub where scientists, students, entrepreneurs, business professionals and investors can come together to generate new ideas for disruptive innovation, test them using advanced lab infrastructure and create products and solutions capable of commercialization. Campus operations will encompass three main structural areas: experimentation, incubation and acceleration, thus cultivating a science-intensive innovation ecosystem that hosts and fosters the full lifecycle of innovation by offering the tools and skills needed at every stage of the process.

Graphic 3.4. Conceptualization of AIC's innovation creation process



Through active partnerships and collaborations with academia, industry and government, the AIC will develop a rich network of public and private R&D, investment and educational organizations at the regional and international level capable of elevating and strengthening Armenia's position on the global innovation map.

FAST's Innovation District flagship program has received government approval as a program of national interest. Together with the Deputy Prime Minister's Office, FAST has implemented a donor coordination meeting in October 19, bringing together high-level representatives from the government and international and supranational organizations to discuss bringing the program to life. This donor coordination meeting was originally due to be followed by a series of discussions with some of the largest locally based international organizations, conducted through March 2020, though eventually stalled by COVID-19 restrictions. The program was also planned to be presented by the Armenian Government at the UN's SDG Investment Fair in New York in April 2020, which was also cancelled due to the pandemic. These prevailing global restrictions have seen the timeline and negotiations around this program put on hold for now, with only inhouse work continuing to further prepare the initiative for implementation.

Graphic 3.5. Visualizing Armenia's Innovation District

The AIC mega-project is part of FAST's long-term planning for Armenia's STI advancement over a 20-year horizon. A large part of the need for an AIC is due to the fact that Armenia's R&D growth and absorption capacity for R&D expenditure is expected to saturate by around 2023, at which point current R&D expenditure levels will have doubled. Sustaining R&D growth beyond that time towards Innovative Armenia 2041 requires attracting large numbers of international scientists, engineers, startups and companies, as well as catalyzing resources within the country. The AIC is expected to break Armenia's R&D plateau within two to three years of its operation. The program's impact assessment foresees that by year three incubated/accelerated companies will start to generate revenue and expand to create more high-tech jobs and R&D, ultimately going on to diversify Armenia's high-tech industry, which is currently mostly ICT-focused. This scenario offers the trigger for Armenia's technological leapfrog.

Graphic 3.6. Key points of AIC's 10-year impact

20,000 new jobs created

450 companies created

5,000 papers produced

3.1% contribution to GDP

540 patents produced

0.9% R&D expenditure/GDP

The AIC offers impact investors an opportunity to amplify the reach of their capital investments. It does so by shoring up the efforts of multiple players in the national and international STI ecosystem to drive home cutting-edge innovation and scientific advancement for the global good.

NETWORK-BUILDING PLATFORMS

Creating a dynamic in which Armenia's STI ecosystem can generate efficient and prolific innovative outputs requires strong links among the various stakeholders that will form that ecosystem. It also requires the formation of ties between key Armenian stakeholders and the outside world. As a result, FAST programming devotes considerable effort to both strengthening existing links and creating new ones. In addition to organizing small and mid-scale engagements, FAST has also strived to build regular large scale scientific and tech events to strengthen Armenia's positioning as an emerging innovation hub.

FAST has engaged over **6,000 participants** in more than **80 events**. Such events have ranged from Science Talks by scientists for scientists; meetings with high-level officials, such as the President of Rwanda; special workshops for startups with prominent speakers from world leading venture capitalist firms, like 500 startups; demo days; and special events for school pupils to meet young successful scientists who can act as role models. COVID-19 saw us quickly adapt to the new reality, organizing webinars involving doctors, economists, data scientists, foreign state officials and industry leaders, among others. Some of the key programs that we run for the purposes of strengthening Armenia's networking capacity are described in what follows.

GLOBAL COLLABORATIONS AND PARTNERSHIPS

The Armenian STI sector is evolving within the context of a vast international arena of innovation. That arena is composed of networks of scientists, innovators and other public and private stakeholders with a strong interest in scientific and technological advancement. This network includes members of the Armenian Diaspora scattered globally and referred to in an EU-commissioned study as "one of the largest and most sophisticated Diasporas in the world". It is also composed of other aspiring innovator nations seeking to advance on the international stage. It is essential for Armenia to be well networked within the international arena, both to be at the cutting- edge of technological advancement (and therefore exposed to the knowledge and opportunities it offers) and to find new markets and connections for its own technological output.

FAST's international outlook enjoys considerable synergy with the objectives of Armenia's Ministry of Foreign Affairs, which seeks to ensure new opportunities for Armenia internationally. As such, FAST has designed several programs within the scope of its work on global collaborations and partnerships that are designed to expose Armenia's STI sector to a broader international set of players.

INTERNATIONAL ROADSHOWS

We have developed and carried out a number of roadshows in different countries to engage both Armenians abroad and other relevant international STI stakeholders in events designed to help them discover and engage in STI opportunities in or with Armenia. Since 2019 FAST has conducted 7 roadshows across 4 continents, including North America (US), Europe (Russia), Asia (Indonesia) and Africa (Rwanda). In organizing some of these, we have also closely collaborated with the Ministry of Foreign Affairs and relevant embassies. There were also roadshows planned to be held throughout 2020 in France, Germany and the UK, which had to be cancelled due to COVID-19. In November 2020, we continued our efforts in this direction by holding a roadshow in the United States. Our roadshows have thus far successfully engaged over 500 participants in 10 larger and over 20 smaller events.

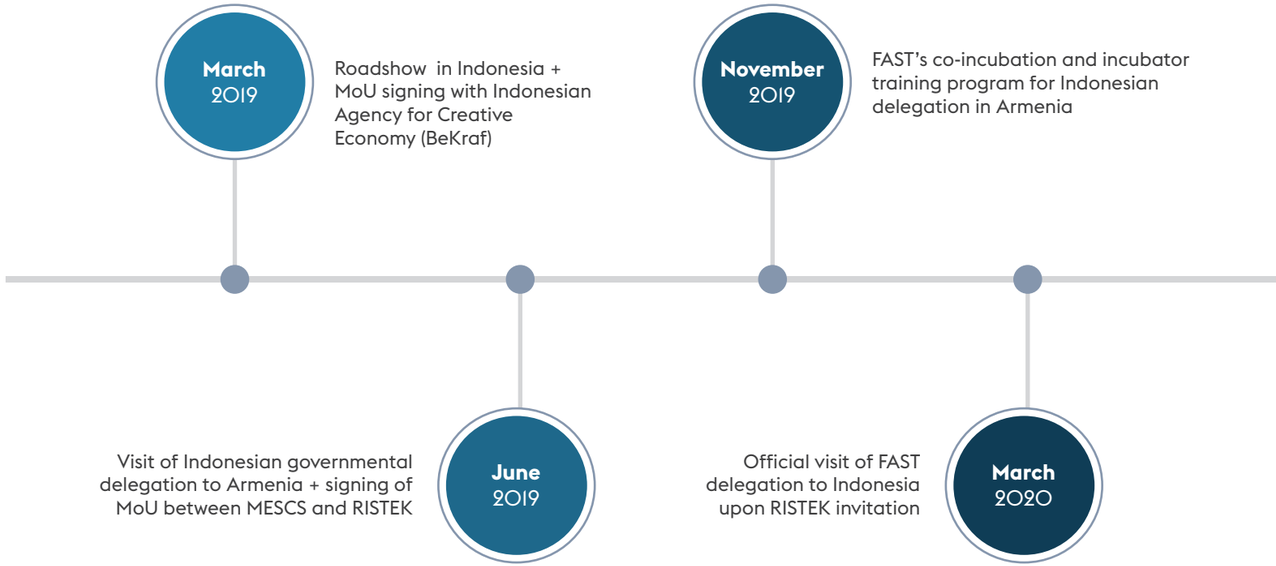
FAST's roadshows have offered stakeholder organizations, institutions and individuals a chance to learn more about current developments and opportunities in science and high-tech industry in Armenia. Harnessing the advantage of Armenia's Diaspora in hubs such as Los Angeles and Moscow, the events also emphasize how involvement in FAST programs provides an opportunity for stakeholders and patrons to enhance their own intellectual, financial and network capacities.

INTERGOVERNMENTAL PARTNERSHIPS

FAST's international roadshows have been highly instrumental in the establishment of important intercontinental joint projects and partnerships, including intergovernmental collaborations with Indonesia and Rwanda. FAST has sought to nurture strategic partnerships between Armenia and wider regions to create opportunities for mutual benefit. Such benefits include access to growing markets for cutting-edge products and solutions developed both in Armenia and partner countries. As two rapidly advancing nations, Indonesia and Rwanda show incredible potential in this regard. Indeed, the Indonesian and Rwandan Governments have also been able to draw upon FAST's knowledge and expertise to help accelerate their own growth trajectories, while benefiting from Armenia's standing as a gateway to Europe and Asia. The vast potential for mutual benefit and learning from such projects renders them hugely exciting.

INDONESIA - GATEWAY TO ASIA

As the world's fourth most populous country (with over 270 million people in 2019), Indonesia has leveraged this asset towards developing its own science and technology sector over the last years. The Indonesian Ministry of Research and Technology (RISTEK) is FAST's tactical partner in a collaboration that began with FAST's first roadshow in March 2019 and has included mutual visits and further discussions of joint programs. A first Indonesian interministerial visit to Armenia saw the subsequent signing of an MoU between the Armenian Ministry of Education, Science, Culture and Sports and the Indonesian Ministry of Research and Technology. A second visit headed by Indonesia's Director-General for Science and Technology saw Indonesian Government representatives from the Ministries of Research and Technology and Foreign Affairs, as well as members of Indonesia's startup and incubator communities, come to Armenia in November 2019. This visit took place within the framework of a one-week co-incubation and incubator training program organized by FAST for our Indonesian partners. March 2020 saw FAST make its own first official visit to Indonesia at the invitation of the Indonesian Government. This envoy significantly contributed to advancing discussions on further collaboration in the areas of research and commercialization between the two nations. The path ahead is to finalize the action plans with all partners and embark on the entrepreneurial, educational and research programs that are planned to be implemented between Armenian and Indonesian leading institutions.



Today, technological development is rapidly advancing and societies are trying to catch up in such a manner that would leave no one behind. In such an environment, innovative approaches boosting effectiveness and efficiency in the shortest time possible while increasing skill levels and expertise become invaluable. This is the essence of the cooperation that started between Armenia and Indonesia, between Armenia's Foundation for Armenian Science and Technology, which is among the avant-garde in the field, and Indonesia's Ministry of Research and Technology. To utilize Indonesian potential to the fullest with the advance methodologies and strategic approaches developed by FAST, a science and education cooperation was established between the two countries.

With the full implementation of the program, a functioning science and technology ecosystem will be established in Indonesia in collaboration with FAST that aims to catalyze and boost regional innovation, and would devise a long-term strategy that would allow moving research into the commercialization phase, thus effectively tying ideas to products and markets, and vice-versa. Education and training are crucial elements in the action plans to be finalized between Armenian and Indonesian leading institutions expanding the cooperation to new levels.

H. E. Dziunik Aghajanian
Ambassador Extraordinary and
Plenipotentiary of the Republic of Armenia
to the Republic of Indonesia

RWANDA - GATEWAY TO AFRICA

Rwanda's Government places great importance on science and technology in the country's economic growth and development, while recognizing the need to strengthen science, technology and innovation across Africa. It has built several Centers of Excellence for science and technology at the regional level and is thus an important partner on the continent. Rwanda is also the driver of the Smart Africa initiative that aims to increase the economic competitiveness of African countries and build a continental knowledge economy, rendering it a regional hub for Africa's scientific and technological transformation. The Rwanda-Armenia intergovernmental partnership is intended to build strong intellectual capital among scientists and entrepreneurs in both countries through joint educational programs and intercontinental collaboration programs creating science-backed ventures in Armenia and Rwanda for global consumption.

In October 2018 President Paul Kagame visited FAST's Creative Campus and shared his vision on building a culture of entrepreneurship with young founders and scientists who were FAST program beneficiaries. Following this visit, a May 2019 FAST Roadshow in Rwanda facilitated important meetings with Rwandan Government representatives, including President Kagame and the Minister of ICT, to find common grounds for potential international cooperation. The fruitful meetings led to a Rwandan Government delegation visit to Armenia within the framework of 2019's Global Innovation Forum. Here, discussions on plans for a partnership program focused around AI and startup capacity building, as well as exchange programs, were followed by the signing of an MoU in March 2020.

The first of these planned collaborations kicked off in October 2020 within the scope of FAST's AI Bootcamp. Here, 3 Rwandan data scientists are undergoing advanced AI training together with their Armenian counterparts as part of the first exchange of its kind between the two countries.

October 2018 — Visit and community meet-up of President Kagame at FAST's Creative Campus

May 2019 — Roadshow in Rwanda, official meetings with President Kagame

October 2019 — Visit of governmental delegation from Rwanda and participation in GIFI9

March 2020 — MoU signed between FAST and Ministry of ICT and Innovation

October 2020 — Rwandan data scientist participation in the AI Bootcamp

> We must create economic opportunity, build a culture of entrepreneurship, get people to take responsibility for improving their lives.

H. E. Paul Kagame
President, Rwanda

NSF-FAST WORKSHOP ON MACHINE LEARNING FOR DISCOVERY SCIENCES

A core task in enhancing Armenia's international profile as a global innovation hub is finding or developing large-scale events at which Armenia's full potential can be showcased. These events invariably present further opportunities for outreach and collaboration and are particularly needed in the fields of artificial intelligence, data science and machine learning.

Recognizing the importance of the latter, October 2017 saw FAST and the United States National Science Foundation (NSF) jointly organize a Workshop on "Machine Learning for Discovery Sciences". The 4-day workshop brought together 45 top-level speakers and nearly 250 researchers and specialists from various disciplines in the field of data science. The workshop's primary objective was to bring researchers and practitioners from machine learning and other data-intensive disciplines to advance cross-disciplinary collaborations that could facilitate science discovery in those fields. Another important objective was to establish and promote mutually beneficial collaborations between international and Armenian scientists, researchers and students. The workshop featured leading experts from a number of fields, including researchers focused on foundational aspects of machine learning and practitioners interested in its various applications. It also featured a New Voices session, during which young and innovative Armenian researchers were given the chance to present the results of their work.

The NSF-FAST Workshop provided widespread publicity for Armenian science and Armenia as a whole. It offered a rare opportunity for the Armenian academic community to network with international colleagues and identify possible points of collaboration. As part of this collaboration platform, several important memorandums were signed by FAST, including with Armenia's Ministry of Education, Science, Culture and Sports, and the University of Southern California and Hamburg University of Technology.

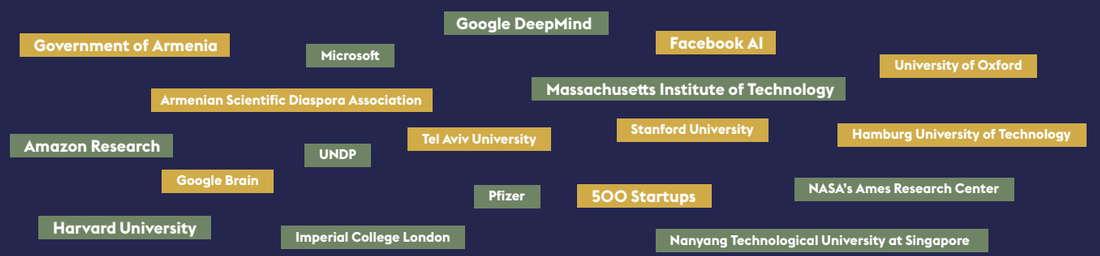
I would like to see that years later we talk about this workshop with reference to some ground-breaking innovations in the world, some cutting-edge developments, and that at the NSF-FAST Workshop we met each other and came up with these ideas. We are glad to see that the ecosystem is growing, otherwise we would not have been sponsored by our industrial partners.

Naira Hovakimyan
Workshop Co-Chair
Member, Board of Advisors, FAST
Grafton and Wilkins Professor of MechSE,
University of Illinois at Urbana-Champaign, United States

GLOBAL INNOVATION FORUM

At an early stage in its operations, FAST identified the need for a large regular international forum to create bridges among academia, industry, governments and international organizations, assembling the brightest minds and executives from diverse worlds to shape the future of scientific and technological transformation.

The Global Innovation Forum has become a FAST flagship event organized annually since 2018. Each Forum carries a specific umbrella topic, with GIF18 being dedicated to “Engineering the Evolution” and GIF19 exploring “Transforming Intelligence”. The two forums were organized in partnership with the Armenian Scientific Diaspora Association (ASDA) and the Armenian Government, and have been privileged enough to benefit from the participation of government leaders as distinguished forum speakers. Speakers and participants of the Forum represent giants of industry and academia.



The Forum has served as a platform for high-level representatives from governments and international financial institutions to share insightful outlooks. These have included speeches by Armenia’s Prime Minister, President, Ministers of Economy and Environment, state officials from France and Japan and high-ranking United Nations, World Bank and Asian Development Bank representatives.

During GIF18 and GIF19 over 1,400 forum participants and 1,700 guests have attended 80 GIF talks and sessions on the immense impact of AI and life sciences on society and science. Numerous partner events have also been hosted on the GIF platform. They include corporate innovation training with the Applied Innovation Institute, Angel Investment training with Seedstars and the European Business Angels Network (EBAN), a donor coordination meeting hosted by the Government of Armenia for the Innovation District initiative, as well as the signing of several MoUs, such as one between FAST and San Jose State University, and several other local universities.

The Forum has become a hub for vigorous debates, captivating presentations and policy discussions delivered by over 170 outstanding scientists, innovators, executives and thought leaders from 23 countries.

FAST’s commitment to sustainability has also seen the Ministry of Environment’s active involvement in the Global Innovation Forum 2019 – a cooperation that has grown into a joint project on tree plantation and forestry rejuvenation aimed at planting 10 million trees in Armenia on 10 October 2020 (now postponed due to COVID-19).

GIF20, titled “Life-altering Technologies”, was scheduled to be held on 7 October 2020, but has been postponed due to the ongoing COVID-19 pandemic.

The GIF offers companies, academic institutions, international organizations, governments, donors and investors a crucial opportunity to showcase and discuss the latest achievements in the field of AI. It likewise provides an invaluable chance to network and exchange with some of the sharpest minds shaping today’s STI scene both beyond AI, and Armenia.

UNLOCKING ARMENIA'S AI POTENTIAL

Artificial Intelligence (AI) has the potential to become the key catalyst for Armenia's global STI ambitions. Its vast and as-yet-unharnessed potential has already begun to transform every walk of life. Indeed, its prospective application to the medical sciences, business, banking and finance, transport and entertainment, has seen McKinsey Global Institute forecast it to double national economic growth rates by 2035. For Armenia, such dividends could be much higher.

AI sector development offers an exciting level playing field for would-be tech contenders in not being reliant on GDP, population, natural resource wealth or geographic positioning for its advancement. However, the wealth of Armenia's intellectual capital in both mathematics and natural sciences places it at a strong global comparative advantage over other nations. Where Armenia has already achieved some notable successes in developing its high-tech ICT exports, the infinite potential of AI offers a whole new scale of opportunity.

The accelerating growth trajectory of the still nascent AI sector is indicative of its potentials. Since 2012, AI compute (the total computational resources spent on training AI models) has been doubling every 3.4 months. As of last year, global AI investment was over 70 billion USD. Industry has become the largest acquirer of AI talent, absorbing over 60% of AI PhD graduates in 2018 – up from 20% in 2004.

Moreover, AI is a platform technology that can be applied across a wide spectrum of industries. As such, if one or more industries are hit by a crisis, a country with strong AI capacity can rebalance more readily by keeping its core platform technology intact. This fact underlines not only the commercial but also strategic significance of AI from a country perspective.

In Armenia, AI advancement remains in its early stages. In 2017, EV Consulting found the Armenian ecosystem to have limited yet growing AI capacity. Later in the same year, FAST's own research showed that if enough resources were invested in AI development in Armenia, the country could potentially conquer a significant niche in the global market. This conclusion was supported by the World Bank three years later, when in the Realizing Armenia's High-Tech Potential report it likewise concluded that with investment in tertiary research, Armenia's strong heritage in mathematics could position it as a global hub for pure AI research.

While Armenia had already prioritized the advancement of AI before 2017, only a few public statements had ever been made on its development up to that time. Since then, a wider discourse has started to emerge around AI as a strategic direction for Armenia's technological development through the involvement of different key players in Armenia's STI ecosystem. Major national events, such as FAST's Global Innovation Forum, have also seen the Armenian President, Prime Minister and government representatives start to highlight the importance of accelerating AI advancement in the country. The last three years have also seen these officials refer to sweeping AI-inspired changes in Armenia during interviews and international visits.

In pursuing its four priority scientific disciplines, FAST's principle focus on AI will see it particularly intensify and deepen its work in this area over the next years. **To date, we have designed and implemented 12 programs and initiatives directly contributing to the development of AI**. These interventions have included work on establishing an AI pipeline producing globally competitive Armenian talent, as well as fostering the emergence of new Armenian AI-based tech solutions and scientific verticals.

FAST, like many other institutions, realizes the importance of training and education in data science and AI. This, and investment in Armenia's brightest talents, are crucial to building globally competitive human capital in these disciplines. In 2017, only a few academic and training programs, supported by players like AUA and PicsArt, targeted these fields. Since then, several programs and events have been initiated and implemented by more organizations. These have included the A.I. Alikhanyan National Science Laboratory, the Armenian Code Academy, the National Academy of Sciences of Armenia and the Zil Academy, among others. Moreover, bachelor and master's degrees are now offered by three major Armenian universities: the American University of Armenia, the Russian-Armenian University and the Yerevan State University.

From 2018, FAST began investing in AI-relevant education through various programs with a view to increasing numbers of AI professionals and laying the foundations for future achievements. Such programs have included the recurring AI Bootcamps and Unit 1991's training programs. FAST has played an essential role in the Ministry of Defense's founding and developing of Unit 1991 (for more see: *Unit 1991 Education and R&D* in *Our programs in detail*) – a contribution the potential outputs of which are crucial given recent conflict in Artsakh (Nagorno-Karabakh). The anticipated long-term impact of this program is the creation of a civilian - defense sector - civilian conveyor belt of talent to feed the STI ecosystem with large numbers of AI professionals annually coming out of the army. The program is intended to have a spill-over effect on the high school educational system by enhancing levels of instruction in mathematics, programming and basic ML through pre-army teacher training for high school teachers. It is also anticipated to benefit the higher education system by providing high quality university-level training in the army.

In order to overcome challenging supply and demand dynamics in Armenia's employment market for educated professionals, 2020 saw the Armenian Ministry of High-Tech Industry also launch grants to support stakeholders to train more people in different IT-related fields. Training in subjects like Python and Machine Learning, are thereby intended to provide an additional talent pipeline for this sector.

Prior to 2017, there was little research activity on AI. A mere 10 research papers had been published by Armenian authors in international journals and only around 14 companies with 100 employees focused on ML. These companies were supported by AI and ML-focused enthusiasts, such as the YerevaNN research lab, and the science-backed startup, Krisp (then 2Hz). From 2018, some initiatives to drive more systematic impacts were launched, such as the ISTC research grant program, which also made ML one of its priority areas. In 2019, the PicsArt AI lab at AUA likewise began funding student research projects on ML and computer vision. FAST has, with others, contributed to ongoing discussions with the Armenian Ministry of Education, Science, Culture and Sports, as well as its Science Committee, about the value of system-level programs in boosting AI research. The Science Committee has since announced a list of seven research projects in the fields of "Artificial Intelligence and Data Science", "Quantum Technologies" and "Robotics", which have been approved for funding in 2020. This is an important step towards boosting Armenian AI and data science research.

2020 has also seen FAST design the ADVANCE STEM Research Grant program. This program intends to help Armenia establish field research potential to become an important player in the global market. It launched its first pilot project on ML/AI in September 2020. Here, Arnak Dalalyan, Director of the Center for Research in Economics and Statistics (CREST) at ENSAE Paris, leads a group of local researchers as an international Principal Investigator. FAST will be providing funding and full institutional support to this research group over four years. The project also provides additional tools to further the professional development of the researchers involved through the expertise of the PI and other FAST capacity building initiatives. FAST aims to fund more projects on ML/AI within the scope of the ADVANCE program over the next years. This is expected to increase significantly the competitiveness of Armenia's scientific output on AI at a global level.

COMMERCIALIZATION

FAST seeks to expand Armenia's commercialization potential in AI by initiating programs creating science-based ventures focused on producing AI solutions. To date, this has included the establishment of the Advanced Solutions Center and InVent, launched in 2018 and 2020, respectively. These programs have already built 2 AI-focused ProtoCos operating in drug discovery and AI in banking. In addition, 4 startups are currently prototyping solutions applying AI across different industries, such as human resources and e-commerce.

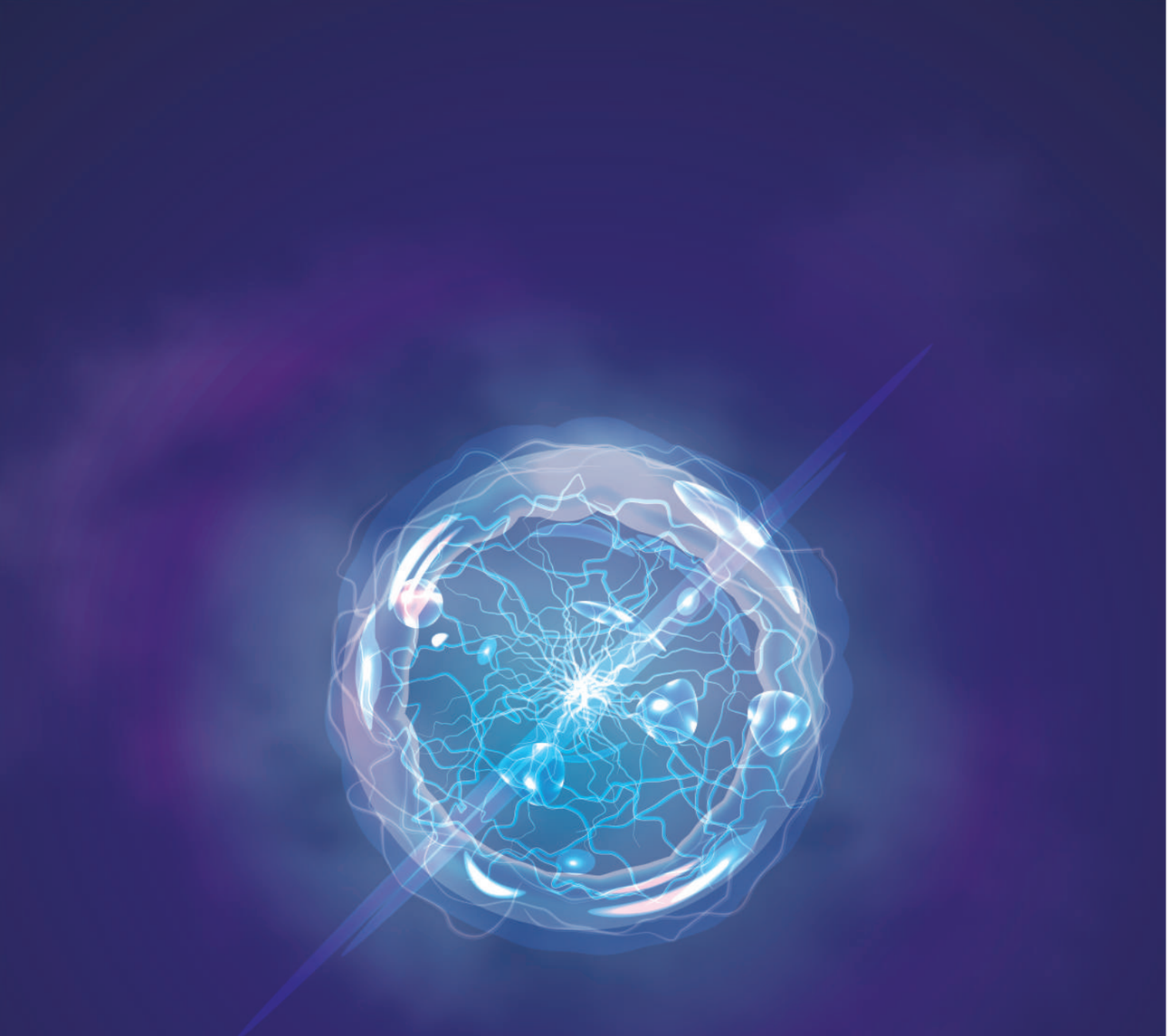
NETWORK-BUILDING PLATFORMS

FAST is also engaged in building large-scale network-building platforms. The 2017 NSF-FAST Workshop on Machine Learning was Armenia's first US National Science Foundation (NSF) initiative and its first conference ever to focus specifically on ML and related fields. Since 2018, FAST's Global Innovation Forum has served as a unique networking platform and become the biggest sci-tech event in Armenia with a specific emphasis on AI. So far, it has brought 1,400 full-forum participants and 170 exceptional speakers from 23 countries to Armenia to discuss AI and its applications in various fields, such as life sciences and physics, etc. The forum positions Armenia as an AI hub and highlights the importance of creating urgency around this direction in the country.

Throughout 2019 there were also several other large events and conferences in Armenia with a focus on AI, bringing together international and local experts in the field. These included the World Congress on Information Technology (WCIT), one of the largest and most prestigious ICT events in the world; the International Conference on Computer Science and Information Technologies; and the Silicon Mountains Forum.

All these initiatives have helped to attract an increasing number of donors by contributing to the positioning of Armenia as a potential destination for investment on AI. These tangible developments are the result of joint efforts by STI ecosystem players, including the Armenian Government, and other public and private sector actors.

FAST has been one of the pioneers of, and biggest supporters in, advancing AI as a priority for Armenia's development agenda. We have put much effort into facilitating both strategic dialogue and ground-breaking programs over the last three years. We are honored to say that the seeds of joint working have started to sprout, and we are even more determined to continue investing in Armenia's scientific and technological development with current and future partners. We believe that Armenia has a huge potential to contribute to the advancement of AI and become a vital part of the global value chain through this sector.



OUR FOUNDATION

GOVERNANCE

FAST was founded on 20 June 2017 by five founders: RVVZ Foundation, Ayb Educational Foundation, Luys Cultural, Scientific, Educational Foundation, Artur Alaverdyan and Noubar Afeyan.

The Foundation's management is composed of the Board of Trustees and the Chief Executive Officer. The Board of Trustees is the Foundation's highest management body and is comprised of seven members. Its competencies include:

- approving the Foundation's strategic plan(s), including its Research and Development plan;
- directing the conduct of entrepreneurial activity by the Foundation itself or through other commercial entities founded by the Foundation;
- approving procedures for the disposal of the Foundation's assets;
- appointing the Chief Executive Officer, including defining his/her remuneration, and terminating his/her powers;
- terminating a board member's powers;
- reorganizing and liquidating the Foundation;
- approving transactions in cases of conflict of interest; and
- forming supporting committees and the Board of Advisors, as well as approval of their by-laws.

VALUES AND PRINCIPLES

Our activities are based on the following values and principles, which have been embedded in our internal policies:

Responsibility and compliance with the law: FAST operates in compliance with applicable legal provisions, professional ethics and internal regulations. Our interests cannot under any circumstances be pursued in violation of the law or of ethical principles. FAST's management and personnel are knowledgeable about and comply with applicable laws and internal regulations in the performance of their duties.

Anti-bribery and corruption: In the course of our activity, we deal with international organizations and governmental institutions. In any dealing with a government institution, FAST adheres to the highest standards of honesty and integrity, and abides by applicable laws. It is prohibited to give, promise to give, offer or authorize the giving of anything of value, including payments, gifts or hospitality, to any government employee, official, candidate or political party with the expectation or hope that this will influence the decision-making of the recipient, or "facilitate" or expedite a routine procedure.

Transparency: We undertake to provide timely, complete and transparent information to all our counterparties.

Impartiality: We avoid any discrimination based on age, sex, sexual orientation, racial origin, political opinion, religious belief and health status of our stakeholders. Also, to ensure impartial decision-making, any conflict of interest or potential conflict of interest shall be fully disclosed in writing before a decision is made within the Foundation under any defined procedure.

Professionalism: We protect professionalism as an essential value for our growth and success. Accordingly, management and personnel conduct is based on high professionalism, commitment and diligence standarts.

Confidentiality and protection of privacy: The acquisition and processing of data, as well as the storage of information and personal data of our personnel and other partners, is carried out in compliance with applicable data protection legislation. This legislation, including the Armenian General Data Protection Regulation, is aimed at ensuring that data is not disclosed to unauthorized persons and/or entities.

Social responsibility: We strive for a better Armenia for all by contributing to the country's scientific, technological, social and cultural advancement through the creation of a thriving STI sector. We keep this broader mission in sharp perspective throughout our programming and daily activities.

Environmental best practice: FAST is committed to complying with all local, municipal and international laws and regulations on environmental protection.

Furthermore, FAST is committed to building environmentally friendly infrastructures and encouraging consideration of environmental issues and impacts throughout its programming, as well as in its office practices.

To ensure the maintenance and respect of the foregoing principles and values within the Foundation and in engagements with external stakeholders, we have developed a set of internal policies, guidelines and handbooks covering the following areas: identification and disclosure of conflicts of interest, procurement standards, fundraising policy, documentation retention policy, intellectual property management and confidentiality policy, communication policy, whistleblower policy, policies on work discipline and disciplinary actions and other operational standards.

BOARD COMMITTEES

Specialized committees consisting of members of the Board of Trustees and the Board of Advisors have been formed to support the activities of the Board of Trustees. The Board committees have at least three members who provide the Board of Trustees with non-binding advice and recommendations concerning FAST's present and future strategy. The following four specialized committees operate within the Foundation:

- Science, Research and Education Committee,
- Science and Technology Investments and Commercialization Committee,
- Audit and Compliance Committee,
- Fundraising Committee.

MANAGEMENT

The Foundation's management team ensures the implementation of our bold strategy. Our team's vast experience in our priority scientific disciplines is an important driving force for our Foundation and its programs.

Our management team also puts into best use the diverse skill sets of our wider team members to achieve the best results and further develop their professional capabilities.

FAST's management team is composed of directors and led by the Chief Executive Officer. Our Directors lead individual units and are accordingly responsible for the activities of those units, coordinating our overall tactical work, operational tasks and objectives, and the outputs of units according to the overarching organizational strategy at the core of all unit activities. Our Directors also consolidate and integrate the Foundation's executive functions with its operational activities, implementing executive decisions through action plans.

Our CEO heads and governs our management team and is the highest responsible entity for the executive branch and the overall functioning of the Foundation. The CEO directs current activities and organizes the implementation of Board of Trustee decisions, as well as representing FAST at the highest level and issuing orders and instructions for the proper implementation of Foundation activities. The CEO is also the linking body between the Board of Trustees, Board of Advisors and FAST's team. The CEO ensures and oversees the implementation of Board of Trustees decisions, seeks and utilizes the advice and guidance of the Board of Advisors, is responsible for executive decision-making, directs and supervises everyday operations, and leads and manages the talents of FAST's team, contributing to their full realization and growth.

TRANSPARENCY AND ACCOUNTABILITY

Each year FAST undergoes a full financial audit with the engagement of Big Four companies such as PricewaterhouseCoopers Armenia and Ernst & Young. For three consecutive years, audit opinions on our financial statements have affirmed that they are presented fairly in all material respects.

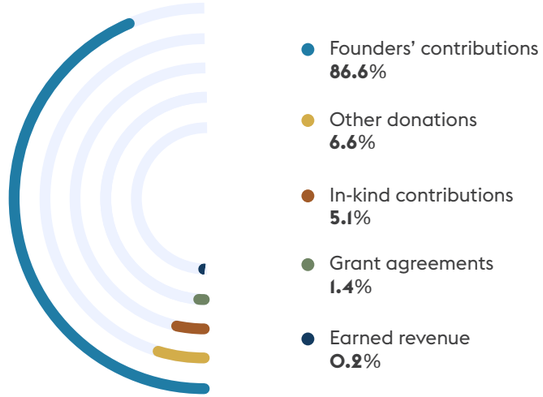
FINANCES AND FUNDING

The last three years have seen FAST secure 6 million USD in funding. Of this, around 87% has been contributed by our founders: RVVZ Foundation, Artur Alaverdyan, Noubar Afeyan and AYB Educational Foundation. Our budget is composed of blended sources, including grants, donations, in-kind sponsorships and earned revenue from fee-based services. Artur Soghomonyan, an Armenian/Russian Investor and philanthropist, and US-based Gateway Industry Inc., have also been among our top donors.

What follows provides a concise overview of FAST's finances over the last 3.5 financial years (June 2017-December 2020).

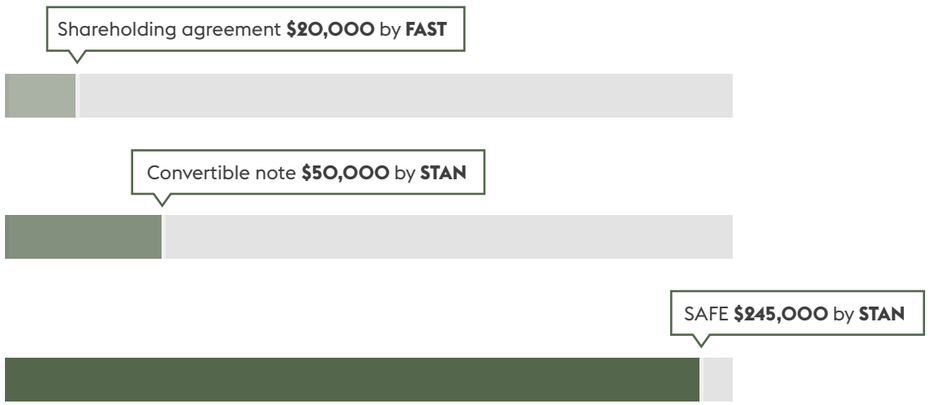
FAST's budget breakdown by type of funds received is presented below:

Graphic 4.4. Source of funds received during 2017-2020, by type



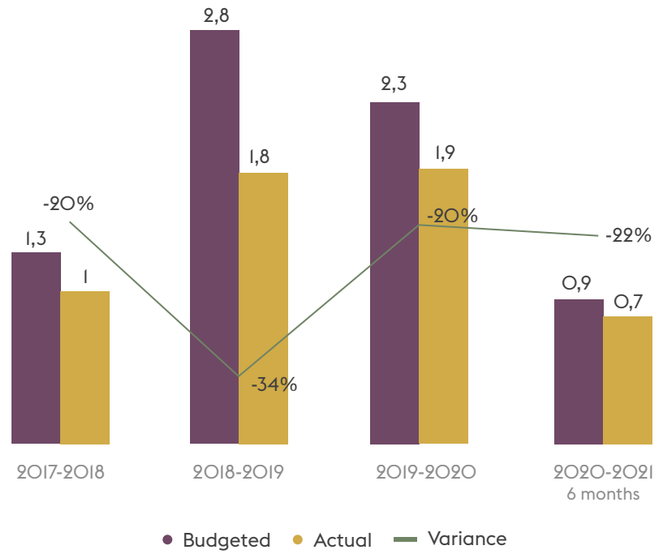
Thanks to the Science and Technology Angels Network and InVent programs, startup investments have been made with the use of blended tools, such as convertible notes, SAFEs (simple agreements for future equity) and shareholding agreements. As a result, a total of 315,000 USD has been invested in 9 startups.

Graphic 4.5. Investments made through STAN and InVent programs, by type



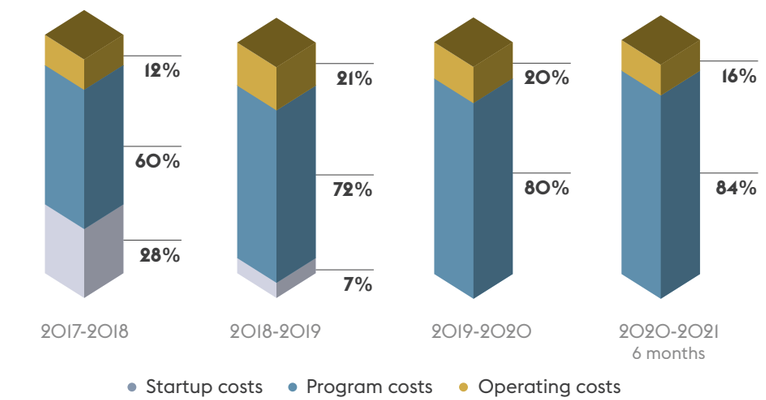
The funds used by the Foundation over the last three and a half years compared to those originally budgeted are shown in the diagram below. The cumulative amount used is around 5.7 million USD, of which 5.3 million USD has been in cash and 0.31 million USD in non-cash.

Graphic 4.7. Actual funds used vs budgeted amounts during 2017-2020, in millions USD



Funds used have been further analyzed to depict the ratio of "startup", operating and program costs to total expenses. All the expenses required for starting up the Foundation, including all research and capital expenses, are presented under "startup" costs. The FAST team continually strives to improve its operating efficiency by reducing the proportion of operating costs year-on-year.

Graphic 4.8. Cost ratios by type for 2017-2020



Graphic 4.7 highlights that FAST has managed to stay under budget for three and a half years. Aside from our efficient and tight control mechanisms, which have resulted in savings, we were also affected by several external factors that resulted in reduced spending. In particular, the COVID-19 pandemic had a significant impact on our finances in the financial years 2019-2021, including as a result of the following:

- Funding and fundraising dropped significantly due to third-party financial constraints.
- Pre-confirmed or confirmed grant-related programs were deferred or suspended.

OUR ENVIRONMENTAL FOOTPRINT

FAST's Creative Campus has adopted some key eco-friendly principles and rules used all over the world. Sustainability is at the core of our activities. We constantly keep sustainable impact in mind when designing our programs, and when it comes to the day-to-day activities that influence our environmental footprint. Thus, sustainable behavior has become an inseparable part of our culture, with the following solutions put into practice:

- Natural plants all over the office
- Recycling – 4,000L of paper and 4,000L of plastic over 1.5 years
- Tap water in water carafes, no plastic bottles
- Labeled bins for waste collection
- Unplugged computers by the end of the day
- Smart power strips all over the office
- One printer for the entire team, with working documents and archives to be stored in the cloud
- Light-emitting diode (LED) bulbs
- Open shades during daylight hours

- Compostable or reusable plates, silverware and serving utensils in the office and during corporate events
- Buying in bulk for coffee and sugar in the kitchen area
- Reusable corporate water bottles and mugs for all staff
- Weekly cleanup of the office fridge
- Healthy days with organic food and snacks, incentivized and appreciated green behaviors
- Policies on working remotely – remote work from home with corresponding software options for the entire staff during COVID-19

THE COURSE AHEAD

Since its inception, FAST has taken a highly dynamic and iterative approach to programming. These early years have involved much scoping, testing, revisal and reform of programs and plans to meet the realities and latent exigencies of the Armenian STI landscape, as well as its socio-economic and political context.

Today, FAST is proud to have facilitated the implementation of 26 programs through collaborations and partnerships that we hope will mature into institutional bonds. These programs are designed to foster the conditions required for developing more ambitious and dynamic initiatives capable of stimulating the kind of energy between complementary spheres on which innovation thrives.

So what is next?

FAST expects the next five years of implementation to settle into a more structured process. That process will maintain, refine and build further upon existing programs while simultaneously developing new schemes with greater focus and depth in fields such as AI and data science. FAST sees AI advancement not simply as a goal in itself, but rather a broad trajectory capable of having a profound impact on Armenia's economy. PwC's Global AI study shows that global GDP could be up to 14% higher in 2030 due to the use of AI. This is the equivalent of an additional 15.7 trillion USD in the global economy – more than China and India's current output combined.

The greatest gains from AI are likely to be made in those countries that leverage the technology the most. For example, China anticipates a boost of 26% GDP in 2030 as a result of its embrace of AI, and North America overall foresees a potential 14% increment. The biggest sector gains will be in retail, financial services and healthcare as AI increases productivity, product quality and consumption. It is thus imperative for Armenia to be able to adjust to the impending Intellectual Revolution. This will require restructuring its workforce by nurturing AI professionals and using the technology to its full potential with prospective spillover effects on other economic sectors.

With this in mind, FAST intends to put much effort into **growing highly competitive human capital** in the field of science and technology, with a strong focus on raising a new generation of scientists, especially in AI and data science. **This means starting young**. We plan to help reshape the country's approach to building education in a way that is better aligned with future societal needs. The next few years will therefore see us target education from at least high school to PhD level. We envisage advanced trainings in mathematics, computer science and machine learning for high school teens. We foresee courses on research design for bachelor and master students. We aim to develop capacity building initiatives to boost the commercialization of science, and help researchers build stronger networks and collaborations with the outside world.

FAST will also continue and scale-up its research programs to help **elevate Armenian research output** to a globally competitive level by building strong collaborations with world-renowned labs and research institutes.

Meanwhile, in seeking to foster greater commercialization capacity, FAST will continue its strong **focus on science-intensive venture builders** to create a robust pipeline of Armenian startups engaged in deeptech – a cornerstone of our ambition **to see Armenia build tech solutions for the global marketplace**. This will also entail expanding funding opportunities to support this pipeline by backing startups through angel investments and venture funds.

These various focused interventions will, of course, be underpinned by our continuing efforts to strengthen collaboration between various Armenian institutions, as well as **building efficient and strong bridges with the outside world**. Robust collaborative links with government, including through policy reform, and with different international organizations, will continue to be core to achieving our mission. In addition, more global collaborations are expected to provide new opportunities for building research partnerships, as well as for exporting technologies built in Armenia to global markets.

Armenia's voyage into the future is one rife with opportunity. It is also fraught with challenges. At FAST, we realize that our **goal is highly ambitious** and that our mission is being pursued in the context of a wider competitive global dynamic. Each day the sun rises over Armenia, it likewise rises over the hopes and ambitions of those in over 200 other nations; nations, some of whom rightly harbor their own dreams of topping the STI charts. There is much to do. But **with a collective vision and collaborative effort** we at FAST are confident that **Armenia will go far in steering a course towards innovative greatness**.

FAST is powered by teamwork. We thus offer a multitude of opportunities for collaborators, donors, investors and partners to explore possibilities for alignment between our work and theirs in driving Armenia's trajectory:

- FAST's ADVANCE STEM Research Grant program offers avenues for supporting or becoming part of **strong international research projects**.
- Our InVent and ASCENT venture builders, as well as our Science and Technology Angels Network provide access to **science-driven Armenian startups** geared towards contributing to the global good.
- Our AI educational programs offer a chance to support the **growth of competitive Armenian human capital** in an emergent field.
- Our Life Science Incubator provides opportunities to support and invest in **innovative biotech startups** at the early stages of their entrepreneurial journey.
- Our Global Innovation Forum offers a key opportunity for those with an STI vision to get to know more about our work, the work of our partners and the sea of **STI possibilities** laid out before today's Armenia.

After glimpsing our work so far, do you see synergies with you or your organization's own values, targets, interests and ambitions ?

! **If so, we reach out to you in a genuine spirit of collaboration.** We would invite you to share in our journey, and hope that you too might welcome us to share in yours.

JOIN THE JOURNEY

LIST OF ACRONYMS

AFEP	Aspiring Female Entrepreneurs Program
AI	Artificial Intelligence
AIC	Adaptive Innovation Campus
ANAU	Armenian National Agrarian University
ASCENT	Advanced Solutions Center
AUA	American University of Armenia
Catalyst	Catalyst Hi-Tech and Entrepreneurship Development Foundation
CEO	Chief executive officer
COSME	European Union Programme for the Competitiveness of Small and Medium-Sized Enterprises
CREST	Center for Research in Economics and Statistics
DS	Data Science
ENSAE	Ecole Nationale de la Statistique et de l'Administration Economique
EBRD	European Bank for Reconstruction and Development
EIF	Enterprise Incubator Foundation
FAST	Foundation for Armenian Science and Technology
FDI	Foreign direct investment
GDP	Gross Domestic Product
GERD	Gross expenditure on Research & Development
GIF	Global Innovation Forum
GII	Global Innovation Index
GSP	Generalized System of Preferences
H.E.	His/Her Excellency
IDeA	Initiatives for Development of Armenia
ICT	Information and communications technology
IP	Intellectual property
ISTC	Innovative Solutions and Technologies Center
IT	Information technology
MESCS	Ministry of Education, Science, Culture and Sports
ML	Machine Learning
MoD	Ministry of Defense
MoU	Memorandum of understanding
OECD	Organisation for Economic Cooperation and Development
PCT	Patent Cooperation Treaty
PhD	Doctor of Philosophy
PI	Principal Investigator
PISA	Programme for International Student Assessment
PPP	Public–private partnership
ProtoCo	Prototype Company
QS	Quacquarelli Symonds
R&D	Research and development
RISTEK	Ministry of Research and Technology of Indonesia
SAFE	Simple agreement for future equity
SDG	Sustainable Development Goal
STAN	Science and Technology Angels Network
STEM	Science, technology, engineering and mathematics
STI	Science, technology and innovation
UK	United Kingdom
UNDP	United Nations Development Programme
UNCTAD	United Nations Conference on Trade and Development
US	United States
USD	United States Dollars
UWC	United World Colleges
VC	Venture capital
VH	Venture hypothesis
WIPO	World Intellectual Property Organization