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ARMENIA

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Independent information guide by German Outsourcing Association

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SURPRISING ENGINEERING

ARMENIA
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Outsourcing Destination Guide Armenia

We present with the Outsourcing Guide Armenia the capabilities and actors of the Armenian IT industry.

We show case unique solutions invented by Armenian industry experts in the form of case studies and project reports.

As a result we help decision makers better understand the advantages and conditions in working with Armenian IT- service providers.

Independent information guide by German Outsourcing Association in co-operation with UITE and German Business Association Armenia

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ARMENIAN IT SERVICES INDUSTRY

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A market overview

The Armenian IT Industry

Based on the 2016 study of the Armenian Enterprise Incubator Foundation

Picture: Serouj Ourishian via Wikipedia (link)

Armenia has a long tradition in industrial computing, electronics, production of semiconductors and software development, due to its role as technology hub already during the times it was part of the Soviet period. It has since managed to retain this position in the region due to its competitive technical workforce, while it also provides a favorable investment climate for larger ICT companies and multinationals.

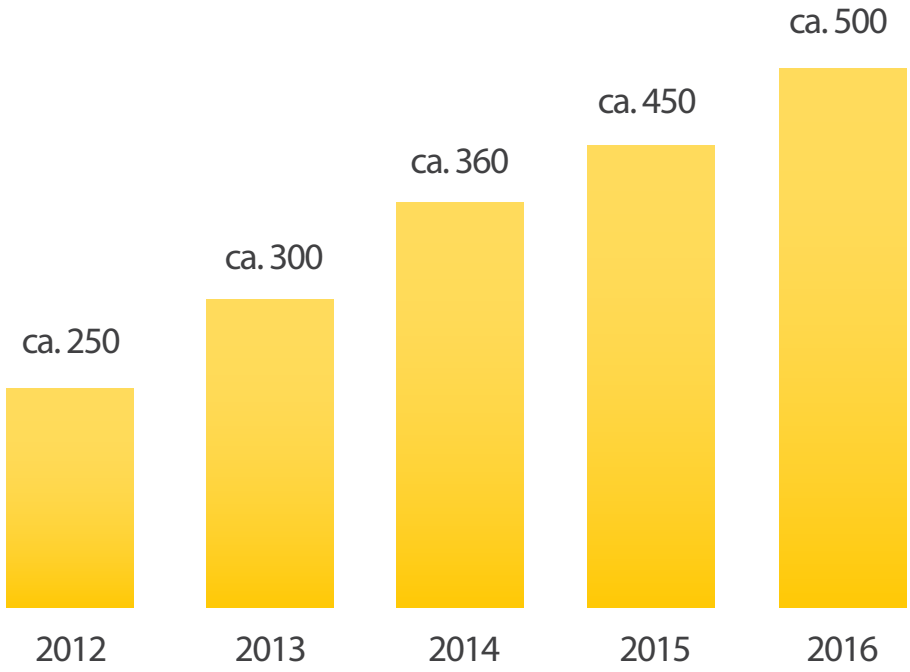
Local ICT companies specialize in embedded software development, semiconductor design, customized software, outsourcing, financial software, multimedia, web design, information systems, and system integration. Armenia has made significant gains in semiconductor design and the creation of related intellectual property.

The 2016 study of EIF states that about 450 ICT companies operate in Armenia (2015), generating an average annual growth of 10%. The majority of these companies are Yerevan-based (about 88%). However Government, public administration and commercial sector have undertaken efforts to support the growth of companies operating in other regions of Armenia. The Shirak and Lori regions are leading due to the development of educational and scientific infrastructure.

In 2015, 70 new companies were established, creating nearly 400 new jobs. In addition, the workforce in the ICT sector increased by around 1.200.

Output of IT services in mln USD

Source: EIF - Enterprise Incubator Foundation



From the 80's till today

Armenia's software and services industry is rather young, with nearly 82% of the companies founded during the time period 2000-2015. The first local private software firm was established in 1987, and within the next five years, the first foreign branch was launched in Yerevan. The transitional period from 1991 through 1997 proved to be challenging for the technology sector since regional conflicts, a declining economy, and brain drain had prevented the economy's general recovery.

By 1998, around 35 to 40 software development firms and ISPs were operating in Armenia, employing, according to various estimates, nearly 1,000 specialists. The workforce employed in the sector in 1998 was notably smaller compared to that of 1987, when YerSRIMM alone employed up to 10,000 people. During the last 11 years, the industry has seen a sharp increase in the number of local startups and branches of foreign companies.

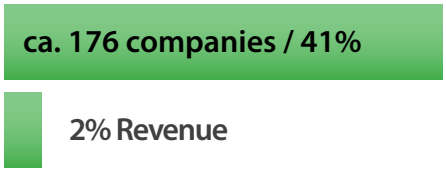
Labour market and employment

In 2015 there were about 15.000 people employed in ICT in Armenia; about 10.500

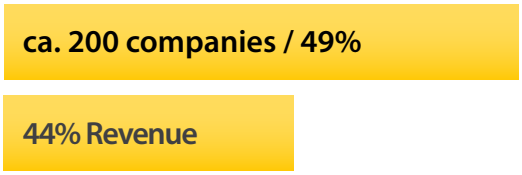
Nr. of IT companies and related revenue 2015

Source: EIF - Enterprise Incubator Foundation

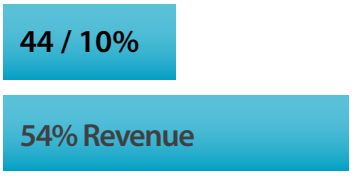
Less than 100.000 USD turnover



100.000 - 1 mln USD turnover



More than 1 mln USD turnover



Total nr. of companies ca. 420
Total revenue 425,5 mln USD

directly in technical fields, like software engineering and IT-project management. The high percentage of employees with Master and higher degrees is noteworthy.

Foreign owned companies tend to be bigger with an average number of employees of 57, while locally owned companies employ an average of 20 people.

The salaries differ widely from 300 USD/month for junior technical specialists and up to 3.500 USD for senior technical specialists, while foreign owned companies offer entry salaries of about 400 USD/month. Employers seem to give higher priority to work experience than to the level of education.

Similar to the division of revenue within the industry, only 4% of the companies employ more than 100 people, which relates to 43% of the total workforce in the industry. The majority of ICT companies, 81% employ less than 25 people and constitute for 30% of the total ICT workforce in Armenia.

Eduction and universities

The educational system in Armenia includes pre-school, pre-higher education (including primary school, intermediate school, high school) vocational (professional-technical), higher and post-graduate education. The private higher education is very popular with 40 private universities and 26 public state universities. The majority is based in Yerevan with some having branches in the regions.

In 2014-2015 nearly 80.000 students were enrolled in the different faculties. About 12% are enrolled in ICT and related fields which accounts to about 9.400 students. About 19% are enrolled in economics and management.

Economic impact of the ICT industry

As seen in other emerging markets, ICT industries can play a central role in the economic development. Also in Armenia the ICT industry counts for 5% of the GDP or 10,3 bln USD (2015). Between 2010 and 2015, the ICT industry grew with 20%. In 1915, the ICT industry contributed to about 11% (2015) of the total export numbers, an increase from the 8% in 2010.

In terms of employment, the ICT sector annually creates around 1.700 high paid jobs, while the output of the universities is about 2.000 graduates per year.

In addition to local companies, there are a number of branches of foreign ICT companies operating in Armenia, the presence of which leaves a positive mark in regards to the sector's visibility and international reputation.

The domestic market

In 2015 61% of the revenue of the ICT industry were accounted for domestically, which constitutes for about 344 mln. USD. This is less than the 2014 domestic market share, due to an increase in exports and a slowdown in the Telecom market.

Due to a substantial growth in the ISP sector, the sales volume have increased by 253% between 2010 and 2015.

Export and foreign companies

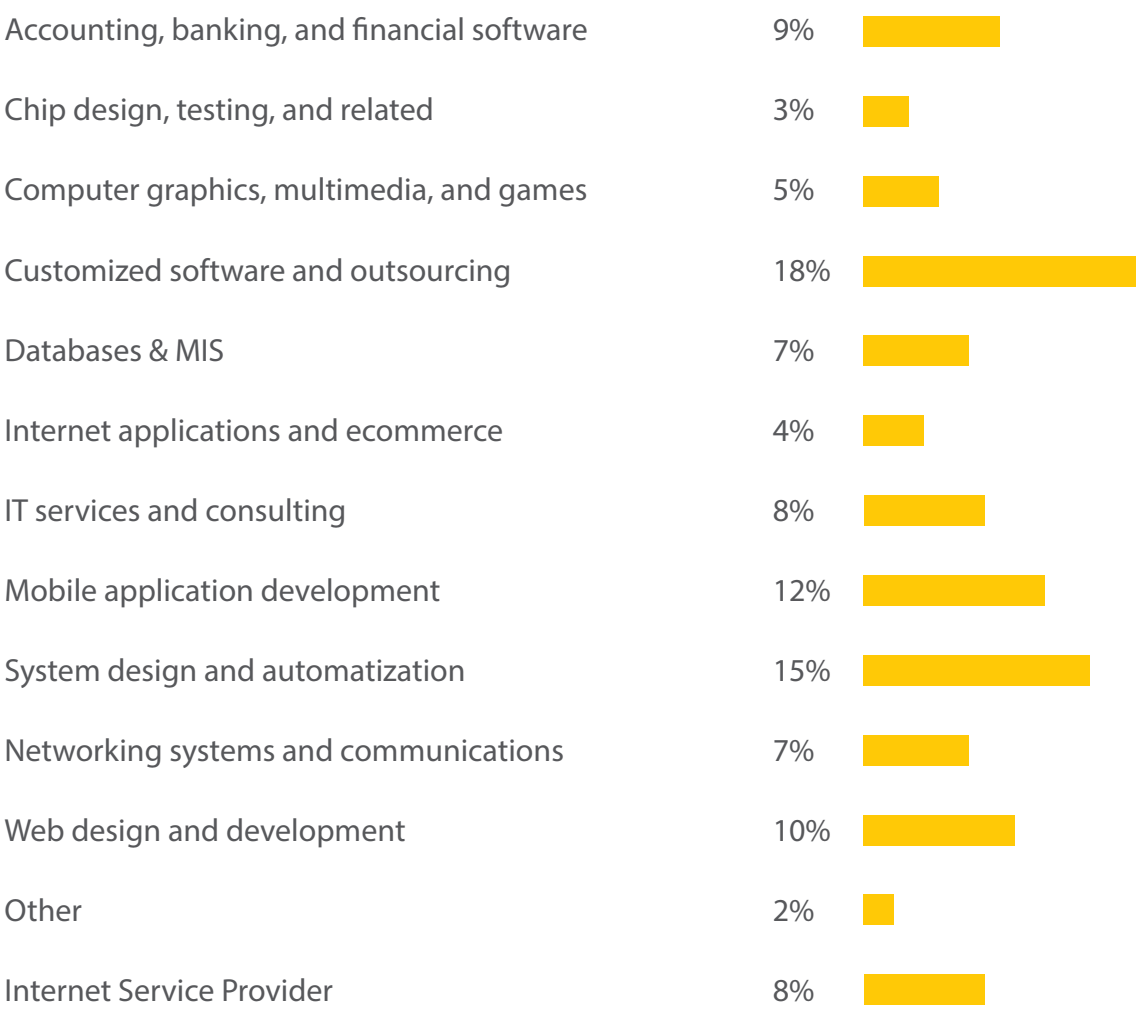
In 2015, about half of the output of the software and services industry or 214.4 mln USD accounts in exports. About 76% of the exports are from branches of foreign companies, but about 50% of Armenian ICT companies export their own products and services.

Largest export markets are the US and Canada with 79,5%, followed by 10.8% to Europe and Russia, and about 8,4% to other CIS countries.

The UAE are the biggest importer of services from Armenia, focusing mostly on outsourcing accounting, banking, and financial services.

In 2015, the study counts 162 companies with foreign ownership, operating in Armenia. This is about 36% of the Armenian ICT industry, which means a growth of about 11% since 2005. These companies are mostly smaller development centers, owned by 44% US companies and about 35% of European companies.

Distribution of number of companies by specialization (2015)



Source: EIF - Enterprise Incubator Foundation

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A talk with Mr. Hrant Khachatrian,
Director at YerevaNN Foundation

Artificial Intelligence **Research** in Armenia

YN²

YerevaNN is a promising scientific foundation with very specific, actual and really interesting objectives. AI (Artificial Intelligence) research is among the especially noteworthy ones. They've just recently launched A Guide to Deep Learning, which is a relatively new branch of machine learning. The ultimate goal of this field is "to teach computers to perform various tasks based on the given data".

We've talked to YerevaNN director Hrant Khachatrian and tried to find out more about their upcoming projects and the current state of the existing ones.

YerevaNN is a research lab that aims to create a good atmosphere for students and researchers interested in machine learning and AI.

Briefly about YerevaNN

"YerevaNN is a research lab that aims to create a good atmosphere for students and researchers interested in machine learning and AI. Unfortunately, state funding of science is inadequate in Armenia, and the difference between salaries for a computer science researcher in academia and industry is extremely high. Most students who want to become scientists leave the country or are forced to go to industry," said Hrant, further adding, "YerevaNN is an attempt to provide an alternative opportunity for them. We are a non-profit foundation funded by private donations and research grants. We don't do any commercial projects and heavily focus on machine learning research. We hope that YerevaNN will become a hub for machine learning community in Armenia and will accelerate the growth of talent in this sphere".

Plans for the future

The integration into the global machine learning research community is one of their plans. Particularly, as Hrant noted, "The short-term plan is to publish some high quality research. Our team is very

young and we do not yet have solid scientific record. The first step would be to become a part of machine learning research community. We just started to collaborate with University of Southern California with the help of Professor Aram Galstyan. In the longer term, we'll try to grow the team, enhance international collaboration and develop high quality educational materials for Armenian universities."

The Deep Learning Guide

We registered 30K visits in just three days ...

As for the newly published Deep Learning Guide, Hrant mentioned that "The guide includes links to many high quality resources for studying deep learning. They range from easy-to-read blogposts to math-heavy video courses and books. Those who can read/watch and understand half of the material will be able to easily get involved in our lab. All the content included in the guide is freely accessible." In addition, it's going to be updated whenever better educational resources are available.

The global feedback

Global sources like Reddit and Hacker News have already noticed the Deep Learning Guide by YerevaNN. *"To our surprise, the guide received a lot of attention around the world. It was trending on Reddit's "r/MachineLearning and on Hacker News"*, Hrant notes. *"There were some negative responses, like "why do we need yet another guide", but most responses were very positive. Some explicitly praised the organization of resources by topics and difficulty. We registered 30K visits in just three days and still have few hundreds daily users, half of which are returning. Visits from Armenia are just 3% of those", said Hrant.*

Thus we can see that the guide is already receiving global recognition and appears to be useful for quite many followers. We don't doubt that this guide and YerevaNN foundation in general will soon have their valuable contribution in the global machine learning sphere.

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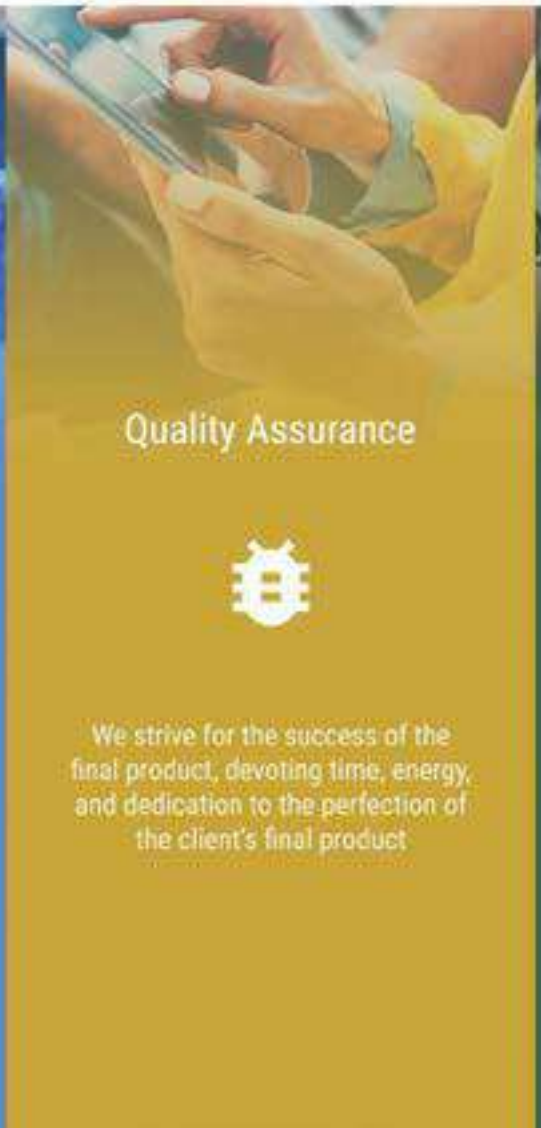

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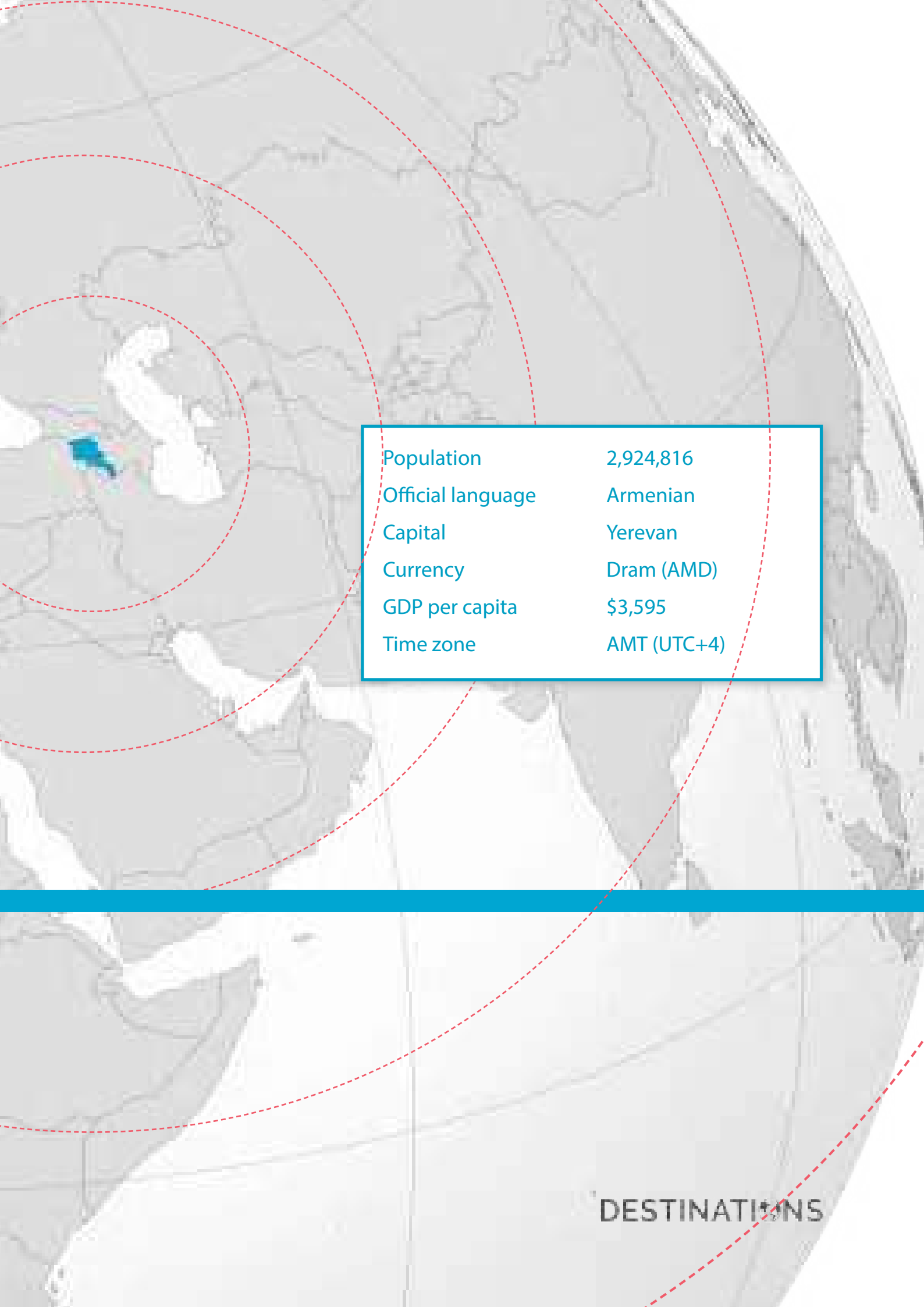
LOCATION



Population	2,924,816
Official language	Armenian
Capital	Yerevan
Currency	Dram (AMD)
GDP per capita	$3,595
Time zone	AMT (UTC+4)

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INDUSTRY INSIGHTS & CASES

OUTSOURCING VERBAND

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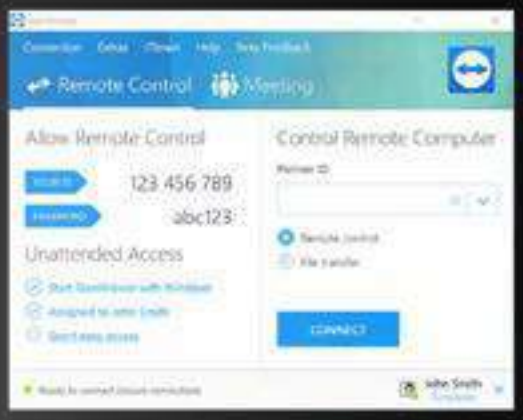

Dr. Mike Eissele, Senior Vice President, Engineering in Germany and Mr. Raffi M. Kassarjian, General Manager, IoT and Monitis in Armenia

Interview with TeamViewer's VP Engineering and GM IoT and Monitis

We have had the chance to interview Mr. Kassarjian in Armenia and Mr. Mike Eissele SVP for Development at Teamviewer in Germany.

For those readers that don't know TeamViewer here a few facts: TeamViewer is one of the leading remote desktop solutions, providing remote access, video conferencing and screen sharing. There are 1,5 billion TeamViewer installations, about 10 million concurrent TeamViewer connections at any given time, worldwide, provided by 700 employees from 40 nationalities. TeamViewer exists since 2005 and is based in Göppingen, Germany.

Raffi you are General Manager at Emerging Products Group, belonging to the TeamViewer GmbH in Germany. Could you please give us a short introduction on your operation in Armenia and your responsibilities in connection with TeamViewer.

In 2011, Monitis, an Armenia-based global SaaS provider, was acquired by the same parent company as TeamViewer. In 2014, both companies were acquired by a European private equity firm. Over the past few years, the two companies (Monitis and TeamViewer), have increased their joint cooperation, to the point where most of the resources in Armenia now work on joint projects with their Germany-based colleagues.

Mike Eissele has served as the Senior Vice President of Engineering at TeamViewer since June, 2016. Prior to this, he was Vice President of Engineering at TeamViewer. Mike joined TeamViewer in 2009 as the Head of Software Development, and since then, he has been responsible for driving the team behind the development and implementation of all of TeamViewer's products.

From 2003 to 2009, Mike joined the Visualization Research Group at the University of Stuttgart as a research associate and earned his Doctor of Natural Sciences in Computer Science for his contributions to various visualization and computer graphics topics.

Mike studied Computer Science at the University of Stuttgart with a focus on visualization, computer graphics, and distributed systems. He also was awarded an MSc in Computer Science in 2002.

Raffi Kassarjian has been the General Manager, Internet of Things (IoT) and Monitis since January, 2016. Before joining TeamViewer, Raffi served as the Head of Product Management, Marketing and Retail Banking Services for Converse Bank, one of the leading retail banks in Armenia. Prior to this, Raffi was Chief Executive Officer of iCON Communications, which was one of the pioneering wireless internet service providers in the country.

Before moving to Armenia, he was Vice President and General Manager at Fair Isaac Corporation (NYSE:FICO). He launched Fair Isaac's first Internet service shortly after joining the company in 1999. He later oversaw various product P&Ls representing 20% of the company's revenues, and was a member of the company's Executive Leadership Team. Prior to Fair Isaac, he was a Senior Manager with Accenture's (formerly Andersen Consulting) Strategic Services group, where he led strategy engagements for clients in financial services, telecommunications, and high technology. Raffi holds Bachelor of Arts and Master of Business Administration degrees from Stanford University.

The teams in Armenia work primarily on products outside of the core TeamViewer product, which are grouped together in the Emerging Products Group, which I'm responsible for. For example, TeamViewer is launching a new product called TeamViewer IoT, which was the result of close cooperation between product management, development and marketing in both countries.

Mike as SVP for Development you have a clear understanding of skills and knowledge needed to develop, maintain and also to bring innovative ideas to TeamViewer. Could you please give us a short introduction of your requirements on skills and knowledge on technical side?

As our company develops for a wide range of technology and operating systems we also have the requirement of different technology skills. For sure, communication is one of the most important aspects to make a cooperation work; therefore, our company switched to English as a default language.

People typically have a good education in technology skills, like programming languages, software architecture, etc.; however, given that we are a company that offers software to millions of people, the focus in software development shifts to maintainability, scalability, security, stability – much more that for typical software development vendors. An awareness of these requirements is very important to us.

TEAMVIEWER INTERVIEW

How does Armenia fit into the TeamViewer Group and how did you come exactly to Armenia – and not to Ukraine or Romania, which are much closer for instance?

We looked for an opportunity to extend our portfolio in a certain software market and found a start-up in Armenia, that's how everything started. We had a closer look at the company and the people working there and were convinced that it would be a good fit to merge with this company.

Raffi and Mike what are the things you value most on your co-operation and what are the aspects that were not so easy to achieve?

We really benefit from different cultures and different approaches to address issues. In contrast, keeping the communication active and balancing the aspects of both cultures is also a challenge.

I agree that cross-collaboration is key to exposing both teams to new ways of thinking and problem-solving. We found that creating personal connections (via joint training or office visits) is key to successful remote collaboration, and we have now incorporated this approach into our planning and execution. Recently, we invested in new, leading-edge IT infrastructure in Armenia to address many of the challenges posed by distance and language.

Thank you for this interview!

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The best part is that we are just getting started. With a larger presence in Yerevan, our success and growth will be unparalleled.

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In our opinion, all people deserve the right to a quality education that will allow them to grow and develop. In accordance with our philosophical values, our classes are taught free of charge.

We suppose, that the need to improve education is constantly on the rise. All the more often, new teaching methods are being devised in the field of education. Many of us have heard much about the Montessori, Waldorf, and Glenn Doman pedagogical systems. Like the abovementioned innovative schools, we revised our educational framework starting with the principle that cooperation is a key pillar of success.

According to these convictions, our students share their skills and help one another to succeed. We believe that the golden rule of education is as follows: “If you want to have educated children, educate your neighbors”.

The Ogma Knowledge Center, being a part of Ogma Applications software development company, leads the way in high-quality research, teaching, and professional education in the IT field. Our students gain experience by creating web and mobile applications with the skills they've acquired. That knowledge helps them to participate in the various projects and advance their career.

Education

Armath Laboratories - An Initiative by UITE

By Karen Vardanyan, CEO at Union of Information Technology Enterprises (UITE)

The establishment of Armath engineering laboratories in the school system of Armenia has been conducted by the Union of Information Technology Enterprises since 2014.

Due to the project, more than 5000 kids have the primary engineering modern education in 225 regions, all marzes of RA, border zones and Republic of Artsakh.

With only 1.5% of the Soviet Union population, Armenia created about 30% of all Military Electronics.

Now we have the aim to restore Armenia as a high technological country by strengthening the basis of the technical education in Armenia, by promoting the engineering orientation of the school children, and by providing modern engineering and scientific-technological education.

There are more than 3 mln vacancies in the IT sector all over the world. In Armenia this number reaches 3000.

By implementing the primary engineering education from 10 years, we'll grow the professional workforce with technical education, which will meet the growing demand.

The growing economic activity of the IT sector will inevitably lead to:

- Development of related industries
- Regional development
- Improvement of demographic situation
- New quality of leaders and entrepreneurs

According to the surveys, after finishing their schools 65% of the Armath graduates continue their education in Universities and work at the same time, 86% of them in the IT sector.

The expansion of the project in all 1400 schools of Armenia will promote the technological education in the country and the strengthening of Armenia's position in the global arena as a country with knowledge-based economy.

Find more information about Armath Engineering Laboratories' on the following webiste:
www.armath.am

Outsourcing Innovation **for** Breakthrough **Performances**

By Daniel Zurfluh, Vice President Business Development Europe at Volo LLC

DESTINATIONS

Outsourcing to a software development outfit may be the worst or the best decision your company ever makes. While an ever-growing number of world-leading companies are relying on outsourcing in search for software services and solutions, a few of them – industry leaders on the lookout for the next big thing – are hoping to find more than just service providers. They are looking for creators, innovation accelerators, and sometimes, even guides to pilot them into the tech world of tomorrow.

Then not all outsourcing IT companies are created equal – one may create a tangle, while another may come to save the day.

In today's hyper-competitive world, many organizations, big and small, are desperate for innovation, but too often they are not getting it in-house and they are not expecting it from their outsourcing partners. However, it does not have to be this way.

In search for innovation leading to competitive advantage

Gap International is a solid case in point. For over 30 years, the company had carved out an incredibly profitable and highly impactful niche as a business and management consultancy helping to boost the performance of the C-Suites of Fortune 1000 companies.

However, Gap International was limited by the niche nature of its clientele. For over a decade, the company had been trying to take a new direction by pivoting to become a software company. Given their enormous base of expertise and accumulated wisdom on how leadership translates into company performance, Gap International realized that by building a suited software, they could speak to a much larger audience.

What they wanted was to transition into becoming a high-tech, software driven performance review and reporting platform to be able to offer their services to a wider audience and keep on successfully competing in their field.

Gap International's first experiences with outsourcing to a software development company was not all smooth – their partners never seemed to be up to the task. Sure, in the last decade, they had managed to cobble together a varied collection of executive performance tools, but their software products were not interconnected or helped the users to see the bigger, integrated vision.

Taking a new direction to find the right fit

Desperate to right the ship, Gap International turned to Yerevan-based innovation boutique Volo on hearing a recommendation about how they had helped many companies in similar situations with innovative solutions designed for the future.

Within 12 months, Volo helped Gap International re-architect their solutions and pace towards innovation in ways they never imagined. Today the collaboration has become a solid partnership that includes continuous support to help the client deliver its services more quickly and efficiently.

Digitizing their services has enabled the company to make their business insights accessible to the broader business community.

> Gap International's first experiences with outsourcing to a software development company was not all smooth – their partners never seemed to be up to the task.

Processes really matter

While Gap International was offered truly innovative solutions, the success of the collaboration was largely determined by the efficiency of project management.

A project management process that enables a software development company to dive deep into understanding the client's business issue is key to ensure a successful, long-term relationship between the client and the outsourcing company. At the core of such a collaboration are teams that embark on examining business needs, existing products and archi-

tectures, and go on inventing ways to stabilize systems, create new ones, improve code quality, fashion them in ways that convey a clear logic, and sustain them so that they would not fail the clients' demands.

Outsourcing companies' ability of delivering brilliant and innovative solutions, as well as a faultless back-end quality lies in their teams' case-by-case approach towards each project. Management, communication, and transparency, if executed efficiently, are the fundamentals of a successful outsourced project.

1) Management

The project management team plays a crucial role in absorbing the information provided by the client, analyzing it, creating a solid understanding of the client's needs and then dividing the whole development process into time-boxed iterations. In Volo's case with Gap International, the team strongly followed Agile engineering practices to enhance built-in quality and fast delivery using Scrum and Kanban as the main methods and framework. A combination of technical tools (including Visual Studio and TFS for task management, Code Repository, and Sitefinity for Content Management) was also employed.

Volo's internal QA team – top-level QA ISTQB certified engineers – took the project's QA to a whole new level. While maintaining manual QA in the initial phase of the project, later on the team initiated automated QA on some project components, thus introducing an automated deployment process to Gap International.

Another aspect of efficient project execution is the long-term commitment of team members, which ensures that a project is delivered with a solid knowledge of and commitment to all its parts. Throughout the lifespan of

Gap International's project, the project team had an amazing 0% staff turnover. Moreover, Volo's average annual employee turnover is around 7%, which is uncommonly low for the industry, thus allowing the assembly of different experienced team structures based on specific project requirements.

It really matters that clients thoroughly understand the essence of the backend and know how the outsourced team is achieving progress.

2) Transparency

It really matters that clients thoroughly understand the essence of the backend and know how the outsourced team is achieving progress. One of the first things Volo's team did was creating transparency throughout the processes, so Gap International was always aware of the exact stage the project progress was at. With goals and tactics designed for two-week sprints, the team delivered pieces of the project, while the whole project progress remained always visible with one click in the program management tool. In helping the client get a thorough understanding of the project's software, the team took on the role of educating the client on all technical specifics related to their own project.

3) Communication

A smooth, two-way communication, including knowledge sharing between a team and a client, is another key to success. Making sure that both teams acquire every bit of information necessary for the deepest understanding of the project should become a requirement. In the case of Gap International, in addition to daily status-calls and e-mail communication, at the start of the project the company's Vice President traveled to Armenia to thoroughly present

their products and share their vision of company's future and the changes they would like to see happen through technology. It was through sheer communication that Volo got to the bottom of their needs.

The secret of such level of systematic approach to project management process and innovation that should be offered by an outsourcing company lies in the type of talent they recruit and work with. Through a carefully refined recruitment procedure that aims at hiring only from the top 10% of the IT talent pool, Volo works with the brightest minds that possess the urge of not only for solving hugely difficult challenges, but also thinking of industry changing ideas.

Innovation and efficiency

Ultimately, an effective outsourcing collaboration will benefit the client beyond just the delivery of solutions. A systematized approach to production processes backed by industry talent, next-gen technologies, as well as a passion for keeping the experience of technology humane may be loaded with the potential of a vision that is going much farther than the current business situation of the client.

Daniel Zurfluh: For the past 16 years, Daniel has worked in the Business Development & Marketing field for organisations in the San Francisco Bay Area, Switzerland and Armenia. Daniel gained insights about the IT industry when living in California and made his move into that sector when he relocated to Armenia a few years ago. Daniel speaks German, English and French.

Daniel is the Business Development VP Europe for Volo and Volo Mobile, one of Armenia's leading innovation outsourcing companies, developing business relations with partners in Europe.
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DESTINATIONS

Platforms for **Heterogeneous** Systems **Development** and Embedded **Design**

By Anna Shahinyan, CTO of Instigate Design, Armenia

Paradigm shift for massive parallel heterogeneous computing: The recent increase of mobile market, robotics, IoT, cloud systems make development of heterogeneous and embedded systems significant. According to Business Insider, the heterogeneous ecosystems are growing rapidly. There are two aspects that can be potential bottlenecks in development:

1 The programming for heterogeneous systems. The programming in heterogeneous, massive parallel systems requires team with multidisciplinary programming skills, as the software should run on multi-CPUs, GPUs, FPGA, DSPs, even multi-CPU computing is not uniform as it used to be in Von Neumann architecture: NUMA architecture knowledge is required.

The described programing skills require paradigm shif from sequential to parallel computing and deep understanding of system architecture and interconnect, experience with close to hardware programming, and HW/SW co-design skills which in the past used to be required only from top system architects.

2 The root of the problem even for uniform massive parallel systems is in the so-called "Von Neumann bottleneck" - shared memory architecture with single (or limited number of) memory controllers providing access to mem-

ory where all variables used by all parallel processes or threads of the application are stored. Thus logically independent parts of the algorithm have to compete for access to their data, thus reducing the overall system performance dramatically, and reducing the impact of Moores Law [1] on performance increase of single-threaded or even multi-threaded applications.

The role of automation systems, frameworks, SDKs development is becoming more significant to decrease the production cost, allow early verifications, and shorten the time to market.

Hence the role of automation systems, frameworks, SDKs development is becoming more significant to decrease the production cost, allow early verifications, shorten time to market. Push-button solutions however are not efficient due to above-mentioned complexity of architecture-exploration which requires intelligent evaluation and decision making steps that are not subject to automation using imperative programming paradigm but only AI or semi- manual interactive platform-based compilation & linking tool-chains and SDKs.

Heterogeneous system modeling, simulation, programming and deployment framework

Our answer to this challenge is Proximus, a massive-parallel heterogeneous system modeling, simulation, programming and deployment framework, tool-chain and IDE, developed since 2006 in-house and with VC funding from EU. It is based on very strong and clear hierarchical design method-

ology and clear decomposition of logical and physical views of the system, and explicit interconnect (message passing semantics) inspired by TLM modeling methodology invented by STMicroelectronics for SoC design, which we brought into the world of heterogeneous computing via Proximus.

It includes advanced technologies such as conversion of C++ applications implemented for the classical Von Neumann architecture into a hierarchical TLM netlist with explicit communication (data and control flow graphs), using various compiler front- ends (EDG, LLVM/Clang, GCC).

It was successfully used by our customers to accelerate full-chip simulation of their future H.264 set-top-box SoC model, reducing the overall run-time of the very large and complex test suite from more than a month down to less than a week on the compute farm. This process is similar to SoC design and EDA, from where we draw experience and knowledge and apply to modern heterogeneous R&D tool-chains, flows and methodology design.

Instigate Application Framework

The constantly growing complex systems require frameworks that allow to create EDA, ESL design tools in a short period and focus on business logic inside, rather on user interface, QA, documentation. It is well known, that the UI and GUI design takes the significant development effort. It is frequently underestimated and causes customer dissatisfaction even when the underlying algorithms have high-performance and features that are not present in the competing solutions.

In house designed and developed Instigate Application Framework (IAF) allows to describe user database in C++/XML based API, and based on the user data schema, IAF generates embedded scripting commands and

graphical user interface, undo/redo, cut/copy/paste, import/export, drag & drop and other important functionalities which would otherwise have to be implemented by the UI developers.

The developed methodology provides facilities both for RnD, QA and technical writer teams. Even business team can get benefits from the framework for demo, presentation preparation. It also provides interface to integrate development environment like version control and tracking systems.

The IAF was deployed to build: static timing analysis and place&route tools for ASIC and FPGA, IP-XACT netlisters and other ESL tools, such as Proximus. It helped ProximusDA team to focus on core technology by greatly reducing coding effort for application GUI and UI and handling almost all of tech-writing effort.

Instigate's background: Starting from 2005, Instigate Design was focused on massive parallel heterogeneous and reconfigurable computing, with applications in signal processing, video coding, image processing, regular expressions and text processing, financial engineering.

Only due to strong technical, mathematical background Instigate Design engineers were successfully involved in German automotive industry without having special certificates.

We engage with companies architecting new experimental heterogeneous systems in early phase of architecture exploration and system specification, by modeling their half-specified systems using system-level modeling environments and frameworks, and using the models to evaluate the system performance in target fields of application. The model granularity is refined in parallel with refining the architecture specification, and more and more automation tools, compilers, place-and-rout tools and linkers and loaders are developed.

Instigate Design had about 70 customers and about 350 projects implemented with partners from Europe and USA (some of them can be announced explicitly such as Xilinx and MicroChip Atmel Aerospace). We provide services not only in EDA, but apply the science intensive R&D skills and experience in the fields of HPC, analytics, bioinformatics, etc.

It is difficult to provide brief overview that can spread light on Instigate Design experience, but wrapping up we would like to mention that during those 10+ years, in addition to our own vocational training center, professional education center and consulting firm, we have created an incubator and seed-fund and founded several design service, custom solution provider and product companies in the sphere of EDA, Embedded Systems, Signal processing, Video and Image processing, IoT, Robotics and UAV autopilot development, Mobile, Web and Cloud computing, modern project-based education, E-Government and E-Commerce.

[1] Moore, Gordon. "Cramming More Components onto Integrated Circuits," Electronics Magazine Vol. 38, No. 8 (April 19, 1965).

The author: Anna is the CTO of Instigate Design and has 10+ experience in EDA, ESL, compiler development, DSP, parallel computing; PhD in Physics; has been awarded for scientific researches in Physics. She lead several projects that en-reach company profile, expertise and bring new experience, projects to company. Her goal is to support Science in Armenia in general and bring into life science intensive projects in Instigate Design particularly.

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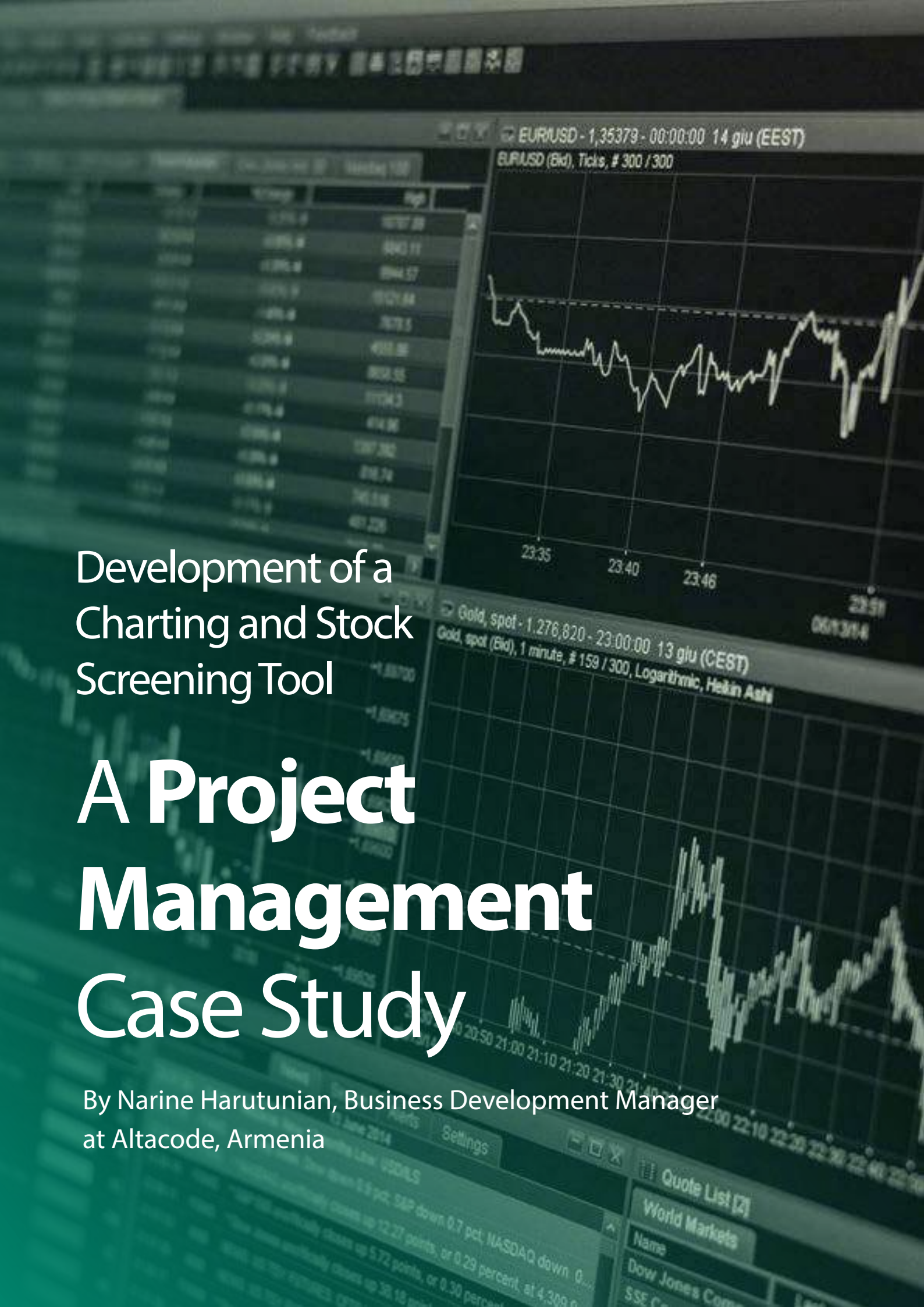


Development of a Charting and Stock Screening Tool

A **Project Management** Case Study

By Narine Harutunian, Business Development Manager at Altacode, Armenia

This paper presents the findings of a case study on software project management for implementation of the charting and stock screening tools for marketsmith.com website. This study is aimed at highlighting the strengths of the project management approach exercised during the project and identifying areas for possible improvement for the future projects.

Many software projects are faced with a common situation: they fail in developing the required functionality within their schedule and planned budget; the results often lack the required quality and or go over time and budget.

To prevent this from happening, project teams first focused on improving the software process and the technology used during the development. Having refined these processes and making sure the project team was staffed with most suitable talent, skill, and experience; the focus became the project management methodology.

I will outline the overall problems that project managers face during the software development projects and then focus on the strengths and weaknesses of the project management process used during the implementation of marketsmith.com.

The case

Project management assessment

The purpose of the study was to understand the project management practices and their impact on the success of the project. The study mainly addressed human factors and organizational aspects.

Project profile

This project was a very high profile project with strict requirements for on-time and on-budget delivery while stressing the importance of implementation of most complex technical solutions exactly per specifications. The charting and screening tools had complex functional requirements for manipulating large amounts of data in real time mode and returning instantaneous results for all user requests.

Project environment

Project had a management and development staff onsite at client's offices in Los Angeles, CA, while core development and QA teams were at Altacode in Armenia. Development and QA had to take place in client's environment, on their servers, via VPN access.

Project management

In addition to detailed planning and setting up matrix for controlling the project quality and productivity, a separate plan was developed for ensuring consistent communication with the remote teams. Emphasis was put on providing transparency on development progress and any possible hindrances on a timely manner to the management; as well as getting feedback and clarifications from the business team and management for any possible ambiguous areas of the requirements.

Methods and tools

Agile development method was used with daily checks on development status and QA outcomes for catching potential codding challenges and the need for requirements clarifications. Ample amount of time was spent on thoroughly studying requirements and clarifying questions raised by the development team.

Results

To measure the success of the project the expected outcomes were compared with the actual ones. Three major expectations were: 1. Complete on time, 2. Complete on budget, 3. The final program should have all functional requirements implemented per specifications.
Our findings showed that all three expectations were met. And significant contributors to this success were the project management practices applied in this project, which are listed below.

At the start of the project, the project manager spent an adequate amount of time to understand the requirements in depth and to work with the development team on detailed planning. Much effort was put into clarification of the requirements. Measurable frequent milestones were defined based on the development team's recommendations and the business team's feedback.

During the development and QA process, the biggest emphasis was put on understanding the progress and measuring it against the set goals. QA was taken into account throughout the development process and timely adjustments were made when needed. At every milestone detailed feedback was taken from the business team with the aim to catch any possible misunderstandings of the functional requirements.

One of the challenges that the project manager was exposed to due to keeping the business team engaged during the development process was the number of change requests submitted for development. It did take extra effort on the project management side and some on the development team to control the scope while managing the expectations of the busi-

ness and management teams ensuring that the project doesn't run late or over the budget.

Given this challenge, a "cost benefit" analysis was done to understand the impact of this approach on the project. The outcome revealed that the benefits far outweighed disadvantages. Many small inconsistencies were discovered by the business team and corrected by the development team during the frequent milestone reviews. Since those issues were caught early, much time and effort was saved in correcting them early on. Another benefit was that the business team had a good idea about the state of the development process which helped with their planning of other activities such as product release and marketing.

Conclusion

The following project management practices contributed to the success of the project:

» Thorough requirements analysis, clarification, and detailed planning prior to starting the development process,

» Setting frequent milestones,

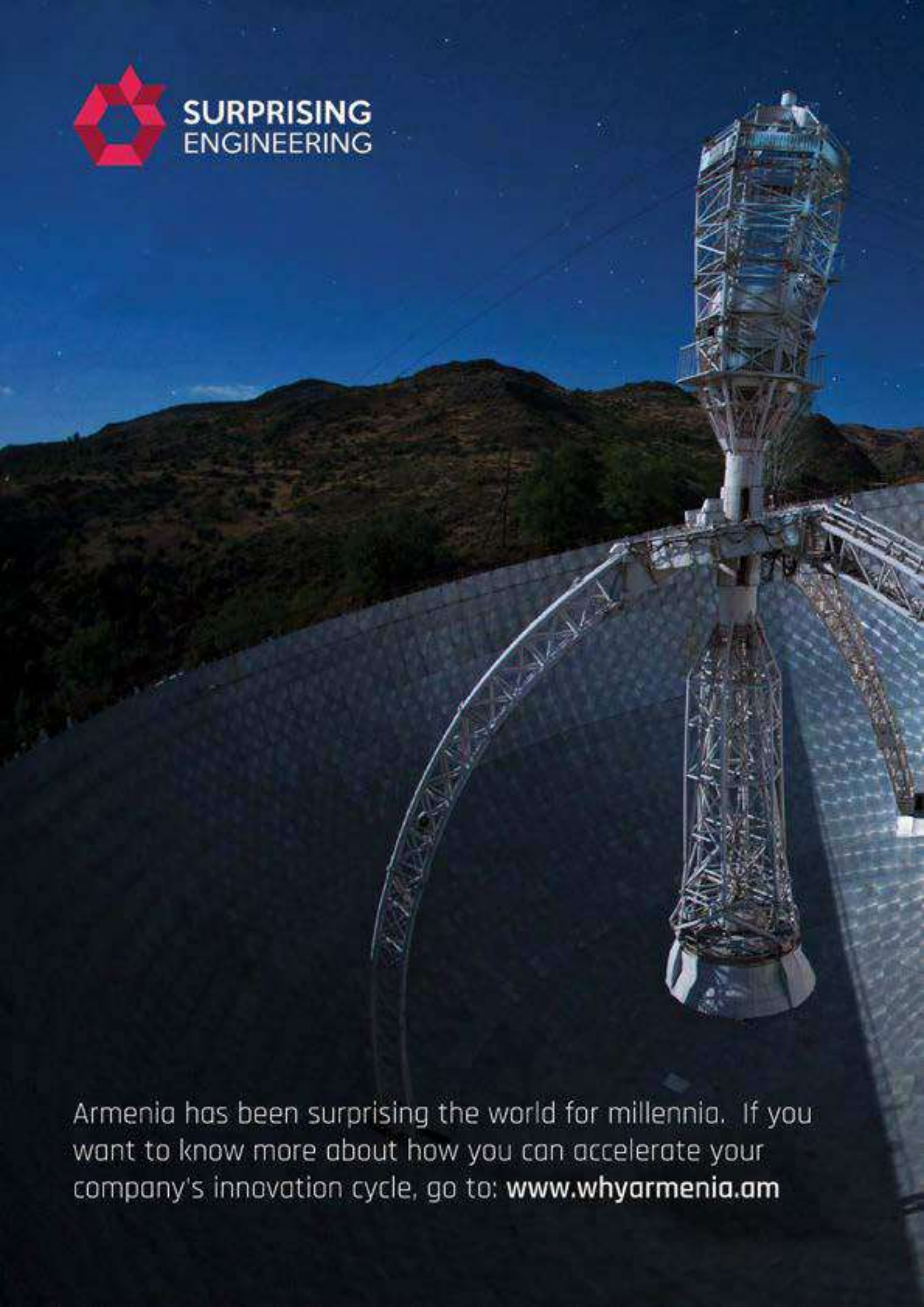
» Proactively addressing possible technical challenges and ambiguous requirements,

» Consistently seeking business team's feedback,

» Keeping tight control on project scope and expectations of all involved teams,

» Ensuring transparency of all processes to all involved team members.

Narine Harutunian, Experienced BD / Marketing Manager with a demonstrated history of working in the information technology and services industry. Skilled in Market Research and Analyses, Business Development and Management of outsourced development projects. Strong marketing professional with a MBA focused in Marketing and Business Management from American University of Armenia coupled with fundamental tech and math background from Applied Mathematics faculty of Yerevan State University.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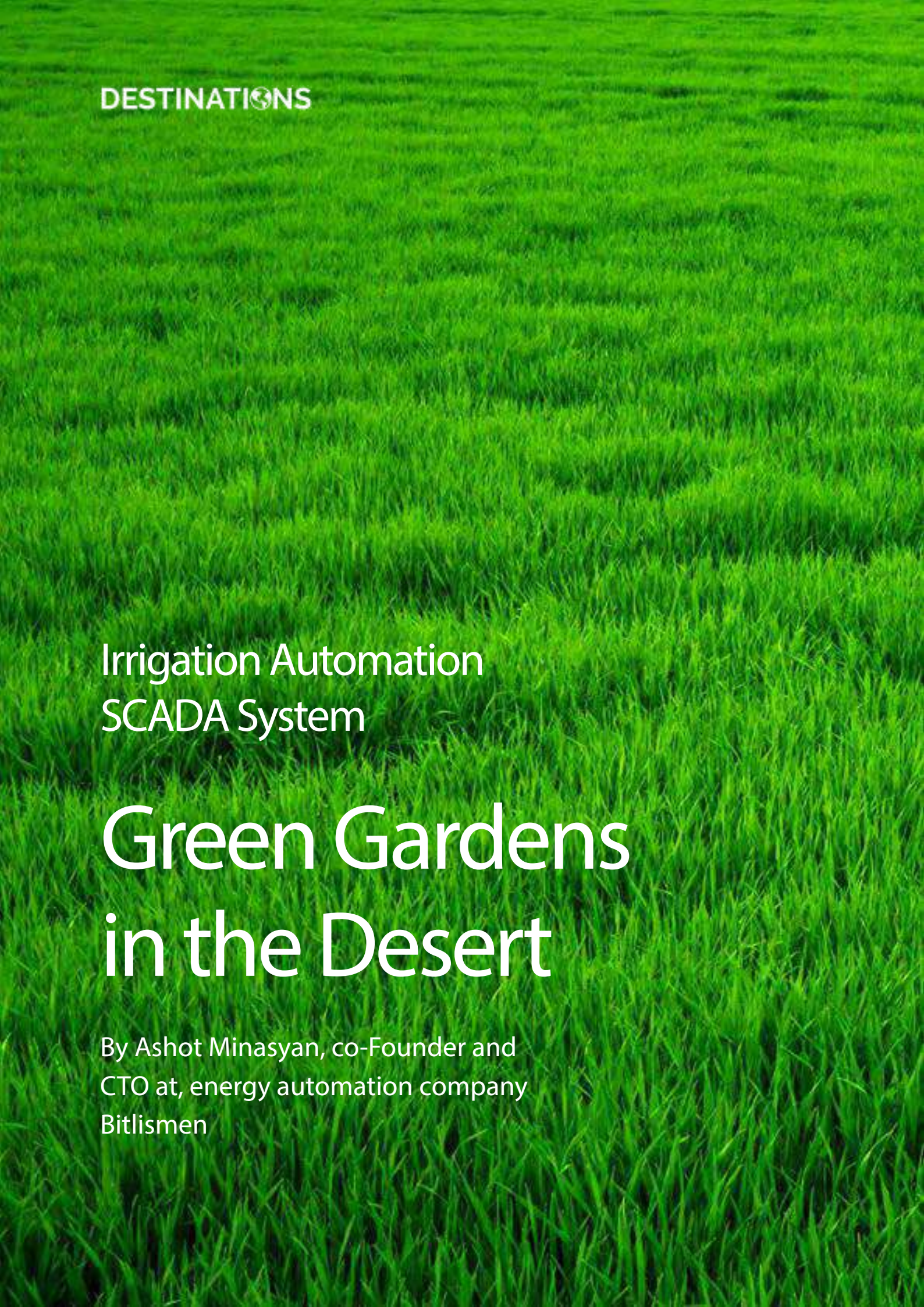
Little Country, BIG INNOVATION

PHOTO BY SUREN MANVELYAN



Irrigation Automation SCADA System

Green Gardens in the Desert

By Ashot Minasyan, co-Founder and CTO at, energy automation company Bitlismen

We were faced with the task to create an advanced and modular SCADA system for automatic and smart control and monitoring of garden irrigation in Dammam Area, Saudi Arabia to have green gardens in desert. The key attribute of a SCADA system is its ability to perform a supervisory operation over a variety of other proprietary devices.

The solution

Combining the benefits of the real-time processor with LabVIEW graphical programming language to create rugged and modular remote terminal units for agricultural weather station, scheduled control, and monitoring of irrigation system.

The existing irrigation systems at customer side were high-end industrial solutions from different vendors. However, those were not able to irrigate the gardens in a proper way, so as a result within the harsh desert conditions the gardens were either over irrigated or under irrigated in both cases causing the gardens to dry or swamp. This behavior was damaging the green plants on the garden, and even damaging the pumps.

The customer needed to have a reliable and modular system for automated and remote irrigation system. The system required to be solely based on industry grade hardware and software in order to operate normally in various weather conditions and reduce the shutdown rates. The system should also include unlimited number of agricultural weather stations, which should calculate evapotranspiration ratio to adjust the irrigation schedule.

Having a green and nice looking yards and gardens in all countries requires a huge amount of water for irrigation. Water is a very important resource throughout the world, where many countries suffer from lack of water. This fact makes the technology companies to design new control algorithms for optimum control over irrigation.

At the other side, making the irrigation correctly is not just saving water, but also helps the plants to grow normally and saves money spent on plant seeds and maintenance.

Application overview

The system consists of a SCADA center and RTUs. The SCADA center consists of a Communication Server and an Operator Workstation. We have designed two types of RTUs.

The areas being irrigated were in a desert with harsh weather conditions. Temperature could rise to 60°C and dry the sand and the plants. The strong winds and sandstorms could create a non-standard environment for regular systems to operate. Our system is industry grade and is able to operate in various hazardous and harsh environment.

At the other hand, the main challenge was to provide a smart system, which could implement the irrigation control intelligently, taking into account the weather abnormalities, and adjust the irrigation process accordingly. This would prevent the over irrigation and under irrigation of the gardens, which could potentially damage the plants (grass, trees, flowers, etc.).

For this purpose we have incorporated a weather station based on NI technologies and could calculate the evapotranspiration ratio ET0 based on different weather parameters like wind speed, solar irradiation, air temperature, rain fall, etc. Based on this we could implement the irrigation in a smarter way by adjusting the irrigation process accordingly, and provide green gardens in Dammam Area, where most of the gardens were dimed to desertification.

before / after

Benefits of the application

This advanced irrigation system, allowed to optimally use the water resources and save energy consumption. Our customer could achieve 20% water savings, 20% energy savings and 30% maintenance and operation cost reduction. Moreover, he succeeded to have green public gardens.

For Dammam Area, which has about 4 million population, our system had a big social impact, allowing the citizens to enjoy their daily life spending time in the gardens and yards.

Comparing to other similar systems in the market, our system is one of a kind. Our system is fully scalable, easily expandable, includes non-standard features including weather station, ET0 calculation, irrigation adjustment and pump protection.

Conclusion

The meaning of SCADA irrigation system is not just to do it automatically, but also intelligently. In order to design smart and intelligent system, a combination of smart engineers and technologies is needed. We could reach all our goals and cover all the needs of our customer. Using our system, our customer can benefit financially and technically, and what is most important, to have green yards and gardens in the desert areas and extreme heat conditions.

Ashot Minasyan is a co-Founder, CTO at an energy automation company Bitlismen (www.bitlismen.com). Ashot's background is Computer Science and National Instruments Technologies. He leaded the design and construction of their own Hydro Power Plant some 10+ years back in Armenia and started his career on Energy, Renewable Energy and Water Automation. He has end users like Aramco and Royal Commission from Saudi Arabia.

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Volo is one of the most unique IT innovation powerhouses on the planet today. We accelerate industry-changing innovation for our clients and help them get to the Next Big Thing faster. At Volo, we aren't just building the future – the work we are doing for industry leaders and bleeding-edge start-ups is helping to define it.

We are able to achieve such level of innovation due to the fact that we apply razor-sharp thinking and flawless execution on every single project.

Today Volo stands as an increasingly global company with seven kitchens (also known as offices) in Armenia and Ukraine and over a dozen of representations that cover the globe from Silicon Valley to Japan. We are executing some of the world's most challenging projects in:

- Enterprise Software Development
- Mobile App Development
- Blockchain
- Internet of Things
- Edge Computing
- Rapid Prototyping
- Cryptography and Encryption
- AI & Machine Learning
- Cybersecurity and DevOps
- Fundamental R&D

Our business principles that make us stand out of the crowd are:

Bigger: We over deliver on every project
Beyond simply delivering a brief, we aim to become a partner to our clients and deliver every brief along with additional, mostly patentable ideas that take the project to the next level.

Smarter: We only ever hire from the top 10% of the global market
We don't simply look for developers, but rather mathematicians, physicists, and chess masters, who are insatiably curios world-class architects. In our view, the only way to deliver bigger ideas is putting smarter people on every project.

Crazy: We look for The Specials
While there may be a formula for product evolution, there isn't one for getting to disruptive ideas. It takes people that view the world in fundamentally counter-intuitive ways to actually disrupt entire industries. That's why we aim to have among us "The Specials", who, when the rest of us see black and white, find themselves seeing music.

OGMA

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Founded in 1998 Ogma Applications is a software development company based in Los Angeles, California that develops web-based and mobile applications for clients all around the globe.

The research and development, implementation, quality assurance, and deployment of the projects are conducted in the R&D office which is located in Armenia, Yerevan. We specialize in custom business solutions, application development, database design, QA and support, UI/UX Design, and web-enabling businesses. Our cross-platform, technology-independent approach ensures you receive the highest performing, cost beneficial result. We approach every project as this is our own – meaning, we create the best team and the organization structure, we decide on the best process, and we execute to the plan.

Backed by a team of highly certified professionals in multiple facets of development, it's strongly believed that every issue can be resolved. Technical competence in building, testing, and implementing mission-critical solutions and software products, allows us to deliver workable systems to our clients.

If you have a project idea - share it with us.

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OPTYM
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The Optym Armenia is a set of highly qualified, diverse individuals, many of whom have advanced specialized degrees and hail from all over the globe. Optym's employees in Armenia include esteemed technical architects, user interface and user experience designers, database developers, and software quality teams. Most recently, Optym expanded their presence in the heart of Yerevan, Armenia. A sleek, modern and sophisticated office space that is equipped for over 100 employees.

With over 80 employees currently based out of the Armenia office, the space is now Optym's second largest office in the world.

The Optym Armenia team has taken a key role in leading some of Optym's key projects with some of the largest transportation companies in the world.

These include a business intelligence solution for Canadian Pacific Railways, a KPI visualization tool for CSX Transportation, a yard simulation-based planning tool for CSX, BNSF and CP Railways in the U.S. and Canada, a truck plan optimization tool for SAIA, ABF and FedEx in the U.S., an airline schedule optimization tool for Southwest Airlines, and a rail schedule optimization tool for BHP Billiton.

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High Quality & True Partnership - Altacode, is a full service custom software development company that provides customized web, mobile and desktop application development services, backed up with comprehensive quality assurance, advanced technical support, and system maintenance. Founded in 2006 with a small and talented team, Altacode has become a reputable player in Armenian IT sector providing wide range of services to its partners. Over the years we have been working with select clients from US, Europe and Armenia on multi-year engagements.

We are experienced in development of analytical and reporting tools, management information systems, content management systems, web portals, e-commerce solutions, GPS tracking systems, mobile apps. We specialize in serving the following markets: finance, insurance, human resources, transportation, and mobile.

Our client / partner base includes such reputable companies like Chobanian Group, William O'Neil +Co, Smart Systems, Nobel Systems, Accucom Corp, allAware Inc., DProduceMan, Cybervore, YappaTech, CVManagement, K5 Investment Group, Vivacell-MTS Armenia, Good Credit, Prime Insurance, RA Ministry of Labor and Social Affairs, "Nork" Information Analytical Center, WB / Armenia, USAID / Armenia, RA Central Bank.

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CIT (Center for Information Technologies) LLC is one of the oldest IT companies of Armenia. It was established in far 1992 and since that time our uppermost goal is to see successful customers. This is achieved by providing services and products, which are designed by a staff of qualified specialists, through partnering with the leading companies in the market and combining it with the experience from our history.

We believe that this approach will position us among the leading IT companies. Satisfaction of our customers shown by repeated orders and positive feedbacks indicates that CIT is on the right path. The main directions of our activities are software development and provision of integrated solutions (especially connected with e-Government systems). Possessing an assembling line, testing laboratories and the respective staff we are able to deliver the latter using completely in-house made production.

Our success in software development is secured not only by the strong and intelligent approach to quality assurance and technical support but also by extending warranty that we offer for our products, and life-time warranty is our common practice.

German Business Association (DWV) Armenia
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The German Business Association (Deutsche Wirtschaftsvereinigung, DWV) is a non-commercial registered association representing various German businesses in Armenia. It was founded in 2007 as a member organisation for companies actively involved in German-Georgian and German-Armenian economic relations, and since 2016 maintains an independent Armenian branch. DWV Armenia's main aim is to enhance trade and economic relations between the Federal Republic of Germany and the Republic of Armenia, as well as to represent German business interests locally.

As Germany is Armenia's third most important import partners and its sixth biggest partner for exports, approximately 700 German companies are present on the Armenian market, mostly represented by their Armenian partner firms. Our Board is composed of ATL Transport, VOLO Global and Arsana CJSC., as well as the German Embassy in Yerevan as a consulting board member. DWV is a member of the European Business Association in Armenia. It is also part of the German Chamber of Commerce and Industry network (DIHK), official representative of Messe Frankfurt (www.messefrankfurt.com) and Senior Expert Service (www.ses-bonn.de) in Armenia.

DWV Armenia currently counts 48 members, several of which are companies from the IT industry. Information Technology has become one of Armenia's most successful and fastest growing industries within the last 10 years, and domestic companies not only take advantage of their position as an outsourcing location for software development, but also focus on producing and marketing their own software products and services: The Armenian IT sphere's main specializations include custom software development, chip design and testing, internet services, networking systems and communications, internet applications, e-commerce, financial software, IT consulting, and others. The Armenian IT sector offers a multitude of competent and innovative technology partners for German enterprises.

DWV Services

DWV supports both German and Armenian businesses in Armenia with various services, which including:

- Introducing new business partners
- Arrangement of delegate tours
- Market analyses and research
- Promotional and networking activities
- Consulting (trade fairs, logistics, export)
- Legal and tax advice, tariff information
- Publications, periodic economy newsletters

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Erida Technologies LLC is founded in 2016 and based in Gyumri, Armenia. Company is specialized in Development and Testing of Web, Mobile and Desktop Applications.

Its a team of highly motivated and experienced Software Engineers. Services being provided by the company include but not limited to development of web pages and various Desktop/Mobile software applications (including database management systems).

The testing team is specialized in providing all kind of Software Testing/QA activities starting from test planning up to release testing and packaging. Testing services include functional testing, usability testing, performance testing, platform compatability testing, database testing, etc.

Erida's experienced team is also offering development of automated Build/Testing/Deployment Systems working with version control and bug tracking tools and taking into account customer's special needs. Along with the Deveopment services company also provides customer support which is always available to address potential issues, bugs, and implement ongoing product enhancements to keep the developed applications and databases optimized, healthy and secure. The team is well familiar with SDLC Processes and follows the Agile methodology of Software Development.

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Esterox is IT company with the team of vibrant and determined IT professionals gathered together to help create a better world and a better society through software. The secret of our success are Christian values which stand at the core of our company. Hence, all we do we do with firm faith and love.

We have huge experience of creating websites and web applications. The Information about our current and previous projects are available on our company website (http://esterox.am/projects).

Our approach is to identify our clients' needs and then apply best practices to deliver the desired outcomes. We also do outsourcing with the highest quality and affordable market prices.

The satisfaction of our partners is our inspiration. For over 4 years we have been providing high quality services to companies in a wide range of industries from e-commerce to education and health-care. We work with international clients - from USA, Australia, Spain, UK and other countries. We are looking for long term and warm relationships with our partners.

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Progresstech-Armenia is the Engineering Center that provides engineering services in the field of aviation, automotive and general engineering.

We provide static, fatigue and damage tolerance analysis of structure using FEM and hand calculation methods. We provide services for the design of components, parts of automotive, construction and agricultural machines such as construction elements design, cost and weight optimization, reverse engineering and details design for machining, bending and stamping. Body interiors & exteriors design (IP, Hard trims, bumpers& etc.). Automotive body design (BIW). Development Engineering/Work Documentation, Development Engineering (Work) Documentation, 2D to 3D conversion. Development and complex design of mechanical, electromechanical and pneumomechanical robotic systems.

As an export-oriented company, we are proud of our achievements and cooperation with major international manufacturers such as: Sukhoi Civil Aircraft; Engineering Center of Airbus in Russia (ECAR), Boeing Design Center, AvtoVAZ, Renault-Nissan Alliance, and Tesla Motors.

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SFL is a software development company that brings digital transformation to a number of businesses on the globe.

We use innovative technology to deliver personalized multichannel user experiences with higher lifetime value, operating mainly in the Java and JavaScript ecosystems. Our teams form one strong unity with the team of our partners which allows to disrupt industries by using a blend of innovative ideas, hard work and latest technology. SFL was founded in 2006 by a small team of tech enthusiasts who got together to create software tailored to customers' real-world needs. Today, SFL is a harbor to over 80 talented minds who blend that evergreen excitement with hard-won experience to serve customers in achieving greater goals.

Across industries, we provide full-cycle custom software development to help enterprises empower their customers through bridging the gap between business and technology. With offices in Yerevan and Chicago, SFL delivers projects across continents, with the majority of customers coming from the US and Europe.

UITE
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UITE - Union of Information technology Enterprises, was established in 2000 as a business association of ICT companies operating in Armenia.

Our objective is to represent and protetect the interests Armenia's most dynamic industry and to promote and support advancement of research in the ICT sector as well as national and international business activities.

The UITE members are involved in software development, internet technologies and e-commerce, research and development, semiconductor design, and other technology areas. A number of our members occupy a leading position in the global market.

We are UITE:
We open the doors to the world of high-tech for the young and talented
We help the world discover Armenia and its great potential for high-tech development
We spearhead initiatives and programs to further develop the ICT sector
We seek to build an innovative and vibrant future on our ancient land

Our ultimate vision is to place Armenia among the top 20 technologically advanced countries in the world.

UITE advocacy and lobbying:
We provide legal advice and support in the relations of our members with state bodies and try to influence government policies.

UITE education and business:
We support the industry by initiating and running youth educational programs. On the business side we support via national and international programs for business development.

UITE stands for:
Ultimate Creativity
Innovation and Initiative
Talent and Technology
Education and Excellence.

Contact us for first information on the Armenian ICT industry, business environment and on suitable partners for technology and research projects.

Or visit us at the 2019 World Congress on Information Technologies, hosted in Armenia !

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Fimetech is an Armenia-based software company specialized mainly in Artificial Intelligence, Machine Learning, Computer Vision, Embedded Systems Programming, and Robotics.

We have a highly skilled engineering team of about 30 members: programmers, software and hardware engineers, system developers, and designers. Each of them brings a core of useful skills and qualities to the team.

Despite the modest size of our team, we strive to catch up with every field connected to IT, science, and education. The range of our expertise is pretty wide. Alongside with our main fields mentioned above, we also have significant experience in Electronic Design Automation Toolchain R&D, Digital Signal Processing, LLVM Compiler development, Indoor/Outdoor positioning and mapping, Localization systems, Internet Of Things, etc.

We are flexible, responsible, smart, and most importantly, we are enthusiastic about what we do. Our team learns very quickly due to both effective team work and highly diligent individuals. We constantly collaborate with different organizations all over the world and have an impressive management-related experience.

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