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Scaling Biometric Teams in Emerging Regions: Lessons from Armenia

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ABSTRACT

As the demand for biometric programming grows, sponsors are increasingly looking beyond traditional hubs to build flexible and cost-efficient partnerships. Armenia illustrates how emerging regions can meet this demand, not only in the capital but also in regional cities. Choosing the right location is critical: factors include the availability of highly educated people, strong IT talent, and opportunities to reveal and nurture new professionals. This paper examines how these principles guided the decision to expand into Vanadzor, a regional city with a concentrated IT talent base. A supporting case study shows how the previously presented Self-Reinforcing Loop mentorship model was implemented there within one month, accelerating junior development and sustaining quality. Broader lessons will be shared on how to analyze regional potential, balance training with delivery, and align local teams with global regulatory expectations to create sustainable, high-performing biometric groups.

INTRODUCTION

The increasing complexity of clinical trial designs and the sustained demand for biometric programming capacity continue to challenge traditional delivery models. Organizations responsible for biometric functions must scale efficiently while maintaining consistent quality, regulatory compliance, and reproducibility of outputs across studies. These pressures have led to growing interest in distributed operating models, particularly in environments where long-term talent sustainability and workforce resilience are critical.

Armenia provides a relevant context for examining these challenges. The country's technology ecosystem comprises approximately 58,700 professionals and around 1,253 active technology companies, spanning a wide range of industries. Of these companies, approximately 35% (538) operate as product-focused organizations, while around 65% (715) provide technology services, reflecting a diversified market structure. These ecosystem characteristics are summarized visually in Figure 1, which illustrates the distribution of technology companies in Armenia by operating model.

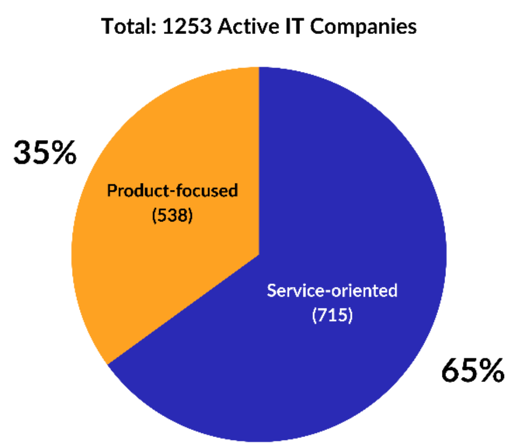

Figure 1. Distribution of the Active Armenian Tech Companies by Operating Model

Within the workforce, about 64% are engaged in technical roles, while 36% support non-technical functions (Figure 2), indicating a mature and structured technology environment This distribution highlights the sustained demand for programming, engineering and analytical roles required to support complex, delivery-driven work, while also reflecting the supporting functions necessary to maintain operational continuity and quality control.

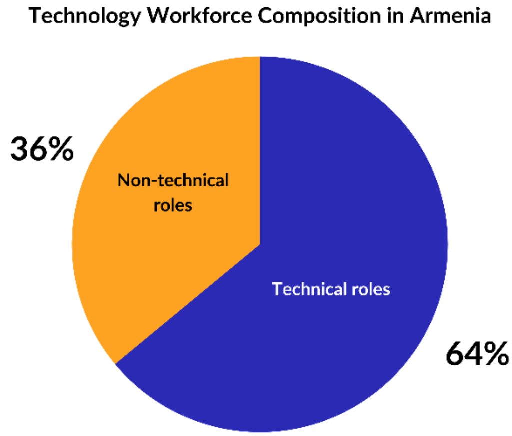

Figure 2. Professionals in the Armenian Tech Sector

Biometric operations in Armenia initially evolved within a centralized framework, primarily based in the capital city, Yerevan, where technical education, infrastructure, and experienced professionals are concentrated. Within this context, STATECS developed and refined a governed delivery model, allowing standards, quality oversight, and operational discipline to stabilize before further expansion was considered. This centralized phase was essential for establishing consistency and reliability within regulated clinical research environments.

Experience gained through this model highlighted two important observations.

- Armenia's strong STEM (Science, Technology, Engineering, and Mathematics) and information technology education systems consistently produce graduates with solid analytical and technical foundations.
- At the same time, academic curricula are not designed to address the full set of competencies required for biometric programming within regulated clinical research environments.

Bridging this gap requires structured, practice-based development within an organizational setting.
To address this gap, a structured mentorship and development approach, referred to as the Self-Reinforcing Loop model was introduced within the centralized operating environment. Following its successful application in Yerevan, the same framework was applied in a regional context to evaluate its scalability. The extension into Vanadzor provided an opportunity to assess whether a governed, mentorship-driven model could support responsible decentralization while maintaining consistency in delivery and quality oversight.

This paper describes the application of this approach using the Vanadzor extension as a case study. The aim is to share practical insights into how centralized governance, targeted training, and structured mentorship can support the controlled decentralization of biometric teams, expanding access to emerging talent pools without compromising quality, regulatory alignment, or sponsor-facing delivery expectations.

CENTRALIZATION VS DECENTRALIZATION IN BIOMETRIC OPERATIONS

In Armenia, higher education institutions, technical infrastructure, and the majority of IT professionals have historically been highly centralized in the capital city, Yerevan. For many years, this concentration shaped how specialized technical functions developed, as organizations relied almost exclusively on capital-based capacity to establish standardized workflows, quality oversight mechanisms, and operational discipline. A decade ago, regional participation in the technology sector was minimal, with very few companies operating outside Yerevan and limited local ecosystems to support advanced technical work.

This pattern began to change in the mid-2010s with the deliberate development of regional technology infrastructure. The opening of the Gyumri Technology Center in 2014, followed by the Vanadzor Technology Center in 2016, marked early efforts to support technology education, entrepreneurship, and workforce development beyond the capital. In parallel, initiatives such as TUMO Centers for Creative Technologies expanded into regional cities, strengthening early-stage technology education and increasing exposure to digital and technical skills outside Yerevan. Together, these efforts contributed to the gradual development of regional talent pipelines.

Over time, these developments were reinforced by changes in industry behavior. Armenian IT companies increasingly began expanding their operations beyond Yerevan by opening regional branches, driven by growing workforce demand, talent availability, and retention considerations. As a result, regional technology ecosystems gradually strengthened, supported by a combination of university branches, STEM (Science, Technology, Engineering, and Mathematics) programs, employer presence, and complementary education initiatives.

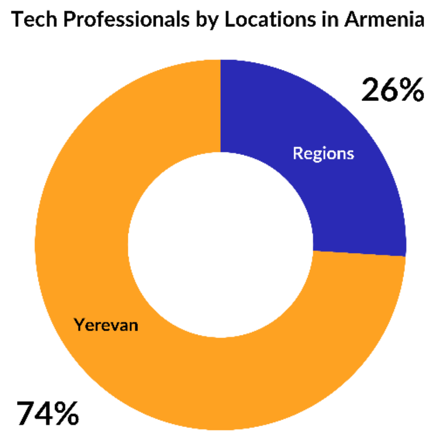

Figure 3: Tech Professionals by Locations in Armenia

By 2025, this shift was clearly reflected in workforce distribution. While Yerevan remained the dominant hub, approximately 74% of technology professionals were located in the capital, with around 26% based in regional cities. This represented a significant departure from the situation a decade earlier, when regional participation was marginal. The data indicated not only the presence of regional talent, but also the maturation of environments capable of supporting sustained technical work.

This gradual redistribution of the technology workforce is further illustrated in Figure 4, which presents the year-by-year distribution of technology professionals between Yerevan and regional cities from 2021 to 2025. This chart shows a steady decline in the proportion of professionals concentrated in the capital, from 94% in 2021 to 74% in 2025, alongside a corresponding increase in regional participation from 6% to 26%. Importantly, the pattern reflects a progressive rebalancing over multiple years rather than a sudden shift, reinforcing the view that regional participation emerged incrementally as supporting ecosystems matured. Figure 4 below provides quantitative context for the discussion on centralization and decentralization, grounding subsequent analysis of regional readiness in observable workforce trends.

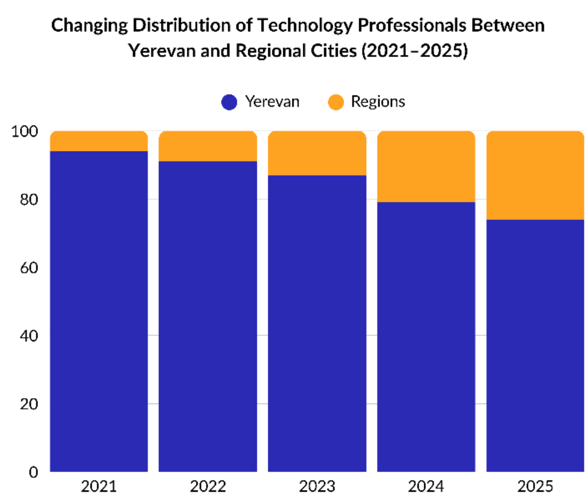

Figure 4: Year-by-year distribution of technology professionals between Yerevan and regions

Within this evolving landscape, Armenia continued to produce strong university graduates with backgrounds in statistics, mathematics, programming, and related STEM disciplines. These academic programs provide robust analytical foundations; however, delivery experience showed that biometric programming requires additional competencies that extend beyond standard curricula. Regulatory standards, validation practices, documentation rigor, and process-driven workflows must be developed through structured, industry-led training that builds on existing academic strengths.

Taken together, these trends reframed decentralization as a natural next step rather than a disruptive change. Given the expansion of technology activity into regions, the growing share of the workforce outside the capital, and the presence of educational and training infrastructure beyond Yerevan, an important question emerged: could the same structured adaptation and training models proven in the capital be extended to regional settings while preserving standards, governance, and quality? This question formed the basis for the systematic evaluation of regional potential described in the following section.

IDENTIFYING REGIONAL POTENTIAL BEYOND THE CAPITAL

Following the decision to explore decentralization, a structured internal evaluation was conducted to assess whether regional settings could support the same delivery standards established in the capital. Rather than assuming regional readiness, the assessment focused on identifying environments where existing conditions could enable sustainable development of specialized capabilities.

Workforce analysis showed that while Yerevan remained the primary technology hub, approximately 26% of IT professionals were based outside the capital, indicating a substantial and growing regional talent presence. This development prompted a more systematic effort to gather and analyze regional data in order to understand where opportunities existed to responsibly develop the biometric industry.

This analysis highlighted several important patterns. Certain regions were experiencing growth in manufacturing and industrial activity, while others were emerging as secondary technology centers with increasing numbers of IT company branches. At the same time, universities continued to operate branches and affiliated programs across multiple regions, offering STEM (Science, Technology, Engineering, and Mathematics) education and producing graduates with strong analytical and technical foundations. Together, these factors indicated that regional talent pools were not only present, but increasingly embedded within evolving local ecosystems.

Based on these insights, attention turned to identifying regions where technical talent availability, learning capacity, infrastructure readiness, and retention potential aligned with existing operating models. Vanadzor emerged as a strong candidate within this analysis, combining an established educational presence with growing technical activity and a workforce profile suitable for structured, industry-led development.

These findings reinforced a key principle underpinning the decentralization approach: regions are not “ready by default,” but readiness can be enabled through structure. Defined selection criteria, structured training pathways, mentorship, and centralized quality oversight were identified as critical enablers for extending established models beyond the capital. This evaluation formed the basis for implementing in Vanadzor the same operating and development frameworks that had proven effective in Yerevan, as described in the following case study.

CASE STUDY: VANADZOR AS A REGIONAL BIOMETRIC EXTENSION

Vanadzor was selected as the first regional extension based on its strong alignment with the predefined evaluation criteria established during the decentralization assessment. The city combines an established educational presence, emerging technical activity, and favorable retention dynamics, making it a suitable environment for extending existing biometric operating models beyond the capital.

From an education and talent perspective, Vanadzor hosts both the Vanadzor branch of the National Polytechnic University of Armenia and Vanadzor State University, which produce graduates in statistics, programming, mathematics, and other STEM-related disciplines. Analysis showed that many graduates from these institutions traditionally relocate to Yerevan to pursue employment opportunities aligned with their qualifications. At the same time, feedback and workforce observations indicated a strong preference among these professionals to remain in their home city if comparable career pathways were available. This dynamic highlighted an opportunity to access technically capable talent while improving retention by enabling local employment.

In addition to academic foundations, Vanadzor demonstrated sufficient talent density, infrastructure readiness, and long-term workforce potential to support structured development. The presence of technology-oriented initiatives and increasing employer activity further suggested that the local ecosystem could sustain more specialized roles when supported by appropriate governance and training structures.

The extension was implemented through a controlled onboarding approach. Candidates were selected based on analytical capability and learning potential and entered structured training pathways aligned with existing biometric standards. Onboarding was intentionally phased to allow close mentorship, continuous feedback, and early quality monitoring, ensuring alignment with established expectations from the outset.

From the beginning, the Vanadzor team was fully integrated into existing delivery, quality assurance, and governance structures. Programming standards, review processes, documentation practices, and oversight mechanisms remained consistent with those applied in the capital. Senior support and quality ownership were centralized, ensuring that geographic distribution did not introduce variability in delivery or compliance.

Importantly, project communication, timelines, and quality accountability remained unchanged, with the Vanadzor team operating as an integrated component of the broader biometric function rather than as an independent unit. This approach reinforced the principle that regional expansion, when treated as an extension rather than a separate entity, can broaden access to talent while preserving consistency and trust in delivery.

IMPLEMENTING THE SELF-REINFORCING LOOP MENTORSHIP MODEL

To support consistent onboarding and skill progression in regulated biometric work, a structured mentorship framework known as the Self-Reinforcing Loop was implemented. The model integrates training, interviews, feedback, and mentorship into a continuous development cycle designed to bridge the gap between strong academic preparation and the additional competencies required for clinical research delivery, such as documentation discipline, validation mindset, and process-driven execution.

The foundation of the model is illustrated in Figure 5, which outlines the four core components of the development process: **Training**, **Interviews**, **Feedback**, and **Mentorship**. These elements work together to create a structured and repeatable approach to workforce development, ensuring that learning is reinforced through both evaluation and guided practical experience.

Figure 5: Core components of the Self-Reinforcing Loop mentorship framework

The Self-Reinforcing Loop operates as a continuous cycle rather than a linear onboarding process. As shown in **Figure 6**, junior professionals receive structured training, apply their knowledge through supervised tasks, and undergo regular evaluation. Feedback from mid- and senior-level staff informs targeted mentorship actions, which are then reinforced through subsequent task execution. This cyclical structure ensures that learning is embedded directly into operational workflows.

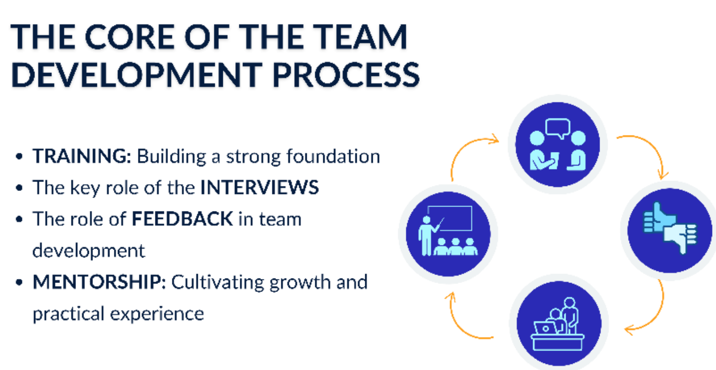

Figure 6: Continuous development cycle integrating training, feedback, mentorship, and performance evaluation

The model is organized around a **junior–mid–senior** structure. Juniors focus on learning and execution, mid-level professionals provide day-to-day mentoring and feedback, and senior staff retain responsibility for quality oversight, standards enforcement, and final accountability. This hierarchy ensures that skill development occurs under consistent governance while maintaining delivery quality.

The impact of the model on workforce performance is demonstrated in Figure 7, which compares key development areas before and after implementation of the Self-Reinforcing Loop. The results show improvements in quality assurance performance, clinical knowledge growth, technical skill development, project execution speed, leadership development, communication, collaboration, and strategic thinking. These gains reflect the value of continuous feedback, structured mentoring, and systematic reinforcement of standards.

Figure 7: Performance improvements observed after implementation of the Self-Reinforcing Loop model

The Self-Reinforcing Loop was fully operationalized within one month, demonstrating both its scalability and practical applicability. Its effectiveness was not dependent on geographic location, but rather on the presence of **defined roles, structured processes, and centralized quality oversight**. This confirms a key principle of the model: it is **organization-dependent rather than location-dependent**, enabling consistent team development across both centralized and regional settings.

CONCLUSION

Biometric teams can be scaled responsibly in emerging regions by combining centralized governance with structured, mentorship-driven workforce development. Using Armenia as a contextual example, and Vanadzor as a regional case study, it demonstrates that decentralization does not need to compromise quality, regulatory alignment, or delivery consistency when it is approached as a governed extension of an established operating model rather than as an independent expansion.

The Armenian technology ecosystem provides several enabling conditions for such an approach, including a large and growing technical workforce, a diversified mix of service- and product-oriented companies, and the gradual maturation of regional technology environments. While Yerevan remains the primary hub, the increasing share of technology professionals based in regional cities reflects the emergence of viable secondary talent pools. However, the experience described in this paper reinforces that the availability of educated talent alone is insufficient for specialized biometric work. Readiness must be actively enabled through structured training, mentorship, and centralized quality oversight.

The Vanadzor case study demonstrates that regional talent can be integrated effectively into regulated biometric operations when development frameworks proven in the capital are applied consistently. By leveraging local academic pipelines, addressing retention dynamics, and maintaining full integration with existing delivery, quality, and governance structures, regional expansion functioned as an extension of the centralized model rather than a parallel or fragmented operation.

Central to this process was the Self-Reinforcing Loop mentorship model, which translated academic foundations into industry-ready capability through continuous cycles of training, evaluation, feedback, and mentorship. Its rapid operationalization and consistent performance outcomes across locations confirmed a critical insight: effective biometric workforce development is organization-dependent rather than location-dependent.

Taken together, these findings demonstrate that the distribution of biometric work across locations can be managed without compromising quality, regulatory alignment, or delivery consistency when supported by structured development models and centralized oversight. The case presented illustrates how operating discipline and mentorship-based workforce development can sustain established standards across organizational settings.

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