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Personnel Strategies for the Formation of Engineering Teams for High-Load Projects

Shatukha Ivan*

Head of Software Development Department,Minsk, Belarus

Email:ivan.shatukha@innowise.com

Abstract

The article is devoted to the study and development of personnel strategies for the formation and management of engineering teams working on projects with high loads. The relevance is determined by the increasing complexity of IT products and the importance of system stability and performance. The scientific novelty lies in the proposed integrated model that combines predictive analysis of staffing needs, a competency matrix for high-load systems, and adaptive methodologies for team management. The work describes traditional and modern approaches to recruiting and developing engineers and examines cases of successful team scaling in technology companies. Particular attention within the study is paid to the role of technical leadership and the creation of a culture conducive to innovation and stress resilience. The aim of the work is to develop a comprehensive strategy that enables the formation of effective and resilient engineering teams. To achieve this, methods of scientific literature analysis, synthesis, modeling, and the study of practical experience are used. Sources devoted to talent management, organizational psychology, and agile development methodologies are examined. The conclusion describes the proposed model and provides practical recommendations for technical directors and HR specialists. The information presented in the article will be of interest to heads of IT departments, project managers, and human resource management specialists in the technology sector.

Keywords: personnel strategies; engineering teams; high loads; talent management; technical leadership; team scaling; Agile; engineer competencies; IT recruiting; organizational structure.

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* *Corresponding author.*

1. Introduction

In the modern digital economy, the ability of companies to design and maintain high-load systems is a key factor of competitiveness. Projects serving large numbers of users, such as global SaaS platforms, healthcare applications, or financial systems, require not only complex technical architectures but also specially structured engineering teams. Failures in the operation of such systems can lead to financial and reputational losses. Traditional approaches to staffing often prove ineffective because they do not account for the specific requirements for stress resilience, synergy, and technical competencies needed to work under peak loads and constant change. This creates a gap between business needs and the actual capabilities of teams, which makes the development of specialized human resource strategies an extremely relevant task [1, 2].

The aim of the study is to propose an integrated human resource strategy model for the formation and development of engineering teams capable of successfully delivering high-load projects.

To achieve this aim, the following **objectives** were formulated:

- Analyze existing approaches and identify the limitations of traditional human resource strategies as applied to high-load IT projects based on contemporary scientific literature.

- Determine the key technical, managerial, and personal competencies of engineers and technical leaders required for effective work in teams on high-load projects.

- Propose a human resource strategy model that includes the stages of selection, onboarding, development, and retention of specialists, as well as principles for forming the organizational structure of the team.

The scientific novelty lies in a systemic approach to the problem. In contrast to works focusing on individual aspects (recruiting, Agile methods), this study proposes a holistic, adaptive model. This model links together project needs forecasting, multidirectional talent sourcing, assessment using a matrix of specific competencies, and the implementation of practices of continuous development and leadership, which makes it possible to create a self-learning and resilient team.

The author's hypothesis is based on the assumption that a human resource strategy grounded in the principles of proactive formation of a talent pipeline, flexible allocation of roles within the team, and the cultivation of distributed technical leadership increases the productivity, innovativeness, and resilience of engineering teams under high-load conditions compared to classical hierarchical management models and reactive recruiting.

2. Materials and Methods

For a comprehensive analysis of the problem of forming engineering teams in high-load projects, up-to-date scholarly works from recent years were used.

Orlova E.V. [1] sets an individualistic vector of personnel strategies for engineering teams in the logic of Industry

5.0, proposing the design of personal development trajectories as controlled loops of competence acquisition (from distributed systems and SRE practices to meta-skills of situational judgment), embedded in the infrastructure of organizational knowledge and digital learning platforms; such personalization makes it possible to link development modules with specific reliability and scalability requirements of high-load systems.

Kumar S. [2] empirically demonstrates that engineer retention and attrition risk are sensitive to the quality of talent management practices — transparent career transitions, fair evaluation, and development support; under duty cycles and hot releases this translates into personnel policies of predictable rotations (for example, dev→SRE→staff) and exchanges complex tasks ↔ sponsored training.

Sharma P., Bhattacharya S., & Bhattacharya S. [9] note that HR analytics and the introduction of AI in the IT sector shift the focus from retrospective reporting to predictive scenarios (attrition forecasting, workload imbalances, deficit of rare skills), which makes it possible to link hiring and training plans with live signals of production telemetry and risks.

Moe N. B., Šmite D., Paasivaara M., & Lassenius C. [5] identify synergy between team autonomy and organizational control in large-scale agile: for coordinated delivery on a shared architecture, light but clear coordination mechanisms are required (integration standards, architectural guilds, synchronization by cadence) that do not suppress local initiative — critical for jointly meeting SLO/SLI in high-load systems.

Karppi M., Aramo-Immonen H., Hyrkkänen U., & Jokisaari M. [10] show that shared leadership surfaces as a response to events (incidents, decision forks), which dictates personnel practices of selecting and developing leaders capable of role rotation and distributed responsibility under stress and uncertainty.

Munir S., Mahmood G., Abdullah F., & Noreen A. [3] indicate that the digital maturity of managers and the mediating role of AI tools correlate with sustainable performance, and in a high-load context with data-informed management of incidents, capacity, and service quality.

Martínez-Fernández S., Bogner J., Franch X., Oriol M., Siebert J., Trendowicz, A., & Wagner S. [4] systematize engineering practices for AI systems, emphasizing differences from conventional development (data uncertainty, model degradation, the need for MLOps, nonfunctional validation by latency/fairness/reliability); in staffing terms, this requires bundles ML engineer–platform engineer–SRE–data architect and roles for observability and data quality.

John M. M., Olsson H. H., & Bosch J. [6] at the business level propose an AI-driven development framework: successful AI integration requires simultaneous changes in processes, metrics, and the architecture of decision making. Consequently, it is more effective to embed AI competencies in domain product teams rather than isolate AI laboratories, and to hire product managers who know ML trade-offs and operational constraints (for example, latency budgets).

Ulhaq F., & Febriansyah H. [7] demonstrate KPI growth after the adoption of a high-performing team model (clear roles, shared goals, feedback rituals, team metrics); for high-load environments these principles are translated into SRE practices (blameless retrospectives, error budgets, shared ownership of availability).

Magana A. J., Amuah T., Aggrawal S., & Patel D. A. [8] investigate team dynamics in large-scale educational courses on software development and show that the key predictors of outcome are coordination mechanisms, dependency management, and distribution of expertise; this validates early selection and training of reliable communications (design docs, lightweight RFCs), which are then scaled into production.

Orlova E.V. [1] and later in 2025 Sharma P., Bhattacharya S., Bhattacharya S. [9] (in the context of analytics) substantiate that personalization and predictive HR loops should be linked to the platform's operational metrics so that engineers' growth trajectories correspond to actual bottlenecks of reliability and scalability.

Thus, it can be said that a personnel strategy for high-load projects rests on four pillars — personalized development and retention with predictive analytics; a balance of autonomy and control and event-driven distribution of leadership; integrated engineering of AI systems and AI-driven product/platform management; the implementation of high-performing team models and coordination practices.

However, the literature also contains contradictions: there is a tension between the benefits of high autonomy and the requirement for strict standardization to meet SLO under peak loads — the empirical evidence of large-scale agile only partially aligns with the logic of total self-organization and with safety/compliance norms, whereas event-driven leadership does not yet set clear boundaries of applicability; HR analytics and retention models are weakly linked with end-to-end operational metrics (error-budget burn, toil, MTTR), therefore the causality load↔HR decisions remains underdescribed; the engineering perspective on AI systems is rich in process prescriptions but is rarely integrated with the organization of on-call, compensation, and role rotations to support models in real time; a significant portion of the empirics relies on cross-sectional surveys or educational contexts, which limits external validity for extreme SLAs; poorly covered remain: profiles of T- and π-shaped engineers for different load scenarios (streaming/hot-path/cold-path), cross-team coordination between platform and product teams under shared SLO ownership, ethics in the use of AI in HR, as well as the economic model of personnel strategies (the cost of rotations and on-call as insurance of competencies). These problematic aspects outline the vector of further research — longitudinal production cases, end-to-end metrics people–process–platform and experimental designs testing combinations of autonomy, standards, and AI-supported decisions in engineering teams of high-load systems.

3. Results

The review of the scholarly literature and accumulated practical experience enables the construction of a coherent personnel strategy for high-load projects. Such a strategy should have a multilayer architecture, simultaneously encompassing individual competencies of specialists, the team's organizational design, and leadership mechanisms that ensure a stable growth dynamic and reproducibility of outcomes.

The foundational principle is a multicomponent model of engineering competencies. For high-load projects, the standard set of technical skills is insufficient: complementary blocks are required, each of which is critical for the predictability of quality and delivery speed. These include technical excellence, architectural thinking, stress resilience and a problem-solving culture, as well as advanced communication and collaboration.

Technical excellence implies deep command of the target technology stack (for example, Python), principles of distributed systems and database design, as well as mature practices for working with cloud providers and containerization tools. What matters is not only operational agility, but also a reflective understanding of the limits of tool applicability under high load conditions, when local optimizations may conflict with systemic resilience.

Architectural thinking requires the ability to see the system as a whole, anticipate bottlenecks, and design solutions with scalability, fault tolerance, and economic feasibility in mind. Design and audit practice using the Voka product as an example showed that systemic architectural oversight makes it possible to ensure stable operation in 190 countries with an audience of over 500 000 users; it is essential that decisions made today remain justified after several years of product growth.

Stress resilience and problem orientation shape the engineer's behavioral profile in incident scenarios. A high-load environment inevitably generates failures and uncertainty; therefore, along with advanced debugging, psychological stability, disciplined root-cause analysis, and the ability to maintain operational composure under strict time constraints are required.

Communication and collaboration ensure organizational cohesion. Clear articulation of technical decisions, willingness to give and receive constructive criticism, and effective interaction with adjacent functions (QA, DevOps, Product Management) increase collective throughput and reduce the transactional costs of coordination.

Technical leadership acts as a system-forming factor in the formation and scaling of the team. Experience in leading large engineering units (including growing a department to 180+ specialists at Innowise) demonstrates that the leader's role goes beyond task dispatching and includes strategic workforce planning, the institutionalization of engineering culture, and the creation of sustainable trajectories of professional development.

Strategic workforce planning rests on aligning the product roadmap with market dynamics: the leader determines target competency profiles in advance and builds a funnel to meet the needs of a 6–12 month horizon. Such proactivity minimizes shortages in key roles and reduces time to functionality release.

Culture formation involves introducing practices that reduce cognitive load and increase predictability: CI/CD, code review, automated testing, and blameless incident postmortems. These mechanisms not only improve release quality but also entrench norms of open discussion of errors as a source of organizational learning.Mentorship and development build a talent pipeline and expand collective expertise. Internal mentoring programs, individual development plans, and targeted preparation of employees for leadership roles make it possible to fill complex positions with internal candidates, reducing dependence on the external market and accelerating scaling [2, 3].

The Voka case study illustrates the specifics of a high-load medical and educational platform. The key challenges included ensuring the performance of complex interactive 3D visualizations across a wide range of mobile devices, designing an architecture capable of withstanding peak loads during global launches, and achieving a level of reliability compatible with medical use cases.

The contribution of the technical function lay in managing critical architectural decisions and systematizing approaches to scalability and fault tolerance. The result was platform resilience amid audience growth and geographic expansion, which confirmed the hypothesis of a direct dependence of a high-load product's success on the synergy of deep technical expertise, strategic leadership vision, and an appropriately constructed team structure in which every participant clearly understands their role in achieving the common goal.

The management and staffing system that was formed, initially implemented at the level of a single department, was replicated at the scale of the entire company. This ensured a noticeable increase in performance and created organizational preconditions for the implementation of Voka-class projects, where technological complexity is combined with high requirements for service quality and availability.

4. Discussion

The comparison of scientific literature with empirical data indicates that routine HR practices are insufficient for the effective staffing of engineering teams for high-load projects. It is necessary to launch a holistic, adaptive personnel management architecture — Integrated Talent Strategy Model for High-Load Systems. Its conceptual framework rests on three interrelated pillars: predictive recruiting, a competency matrix, and an adaptive organizational structure. The team should be conceived not as a fixed set of performers but as a dynamic system — a living organism that coevolves with the project and changes along with it. The model in Figure 1 demonstrates the cyclical, continuous nature of the talent strategy. In contrast to the linear logic found — hired — forgot, the proposed approach relies on constant feedback loops and built-in adaptation. The process starts with strategic analysis: instead of reactively closing an emergent vacancy, a predictive assessment and anticipatory planning of the project's future needs are conducted.

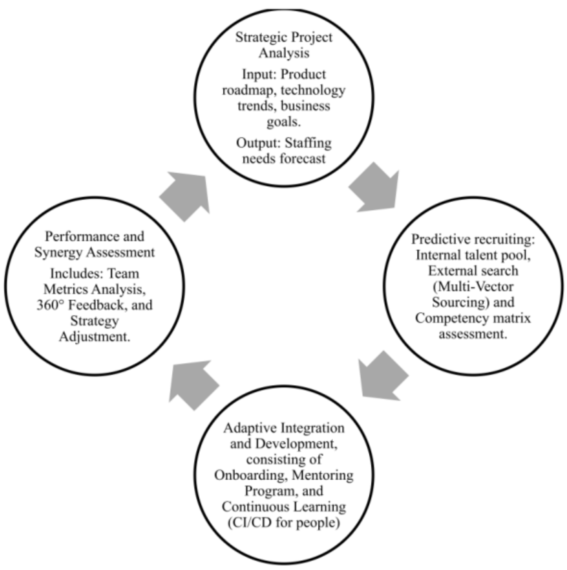

Figure 1: Integrated HR strategy model [1-3]

As can be seen from Figure 1, the system-forming component of the model is predictive recruiting, understood as continuous market monitoring by HR and technical leaders, targeted formation of a talent pool, and the building of durable relationships with potential candidates long before an acute hiring need arises. Such a preventive strategy eliminates the factor of haste and minimizes the risk of forced compromises when selecting key specialists. The next step is to evaluate candidates not by a universal list of requirements, but on the basis of a Competency Matrix specifically developed for high-load projects (see Table 1).

Table 1: Example of a competency matrix for a Senior Python Engineer in a high-load project [4, 5, 8]

Competency category	**Key skills and indicators**	**Assessment method**
Technical excellence	Experience with asynchrony (asyncio), knowledge of message brokers (Kafka, RabbitMQ), experience in designing APIs for high loads.	Live coding session, architectural task.
Architectural thinking	Understanding of CAP theorem principles, experience with microservices, knowledge of resilience patterns (Circuit Breaker).	System design discussion.
Stress resilience	Ability to analyze incidents under pressure, on-call experience, ability to make decisions with incomplete data.	Behavioral interview, analysis of a hypothetical system outage case.
Communication	Ability to justify technical decisions, mentoring experience, skills in maintaining technical documentation.	Discussion of past projects, reference calls.

This matrix provides a more impartial and in-depth evaluation of candidates. At the same time, even flawlessly selected specialists will not achieve high performance in the absence of an adequate organizational architecture. Figure 2 below presents an adaptive team configuration that dynamically changes depending on the project phase.

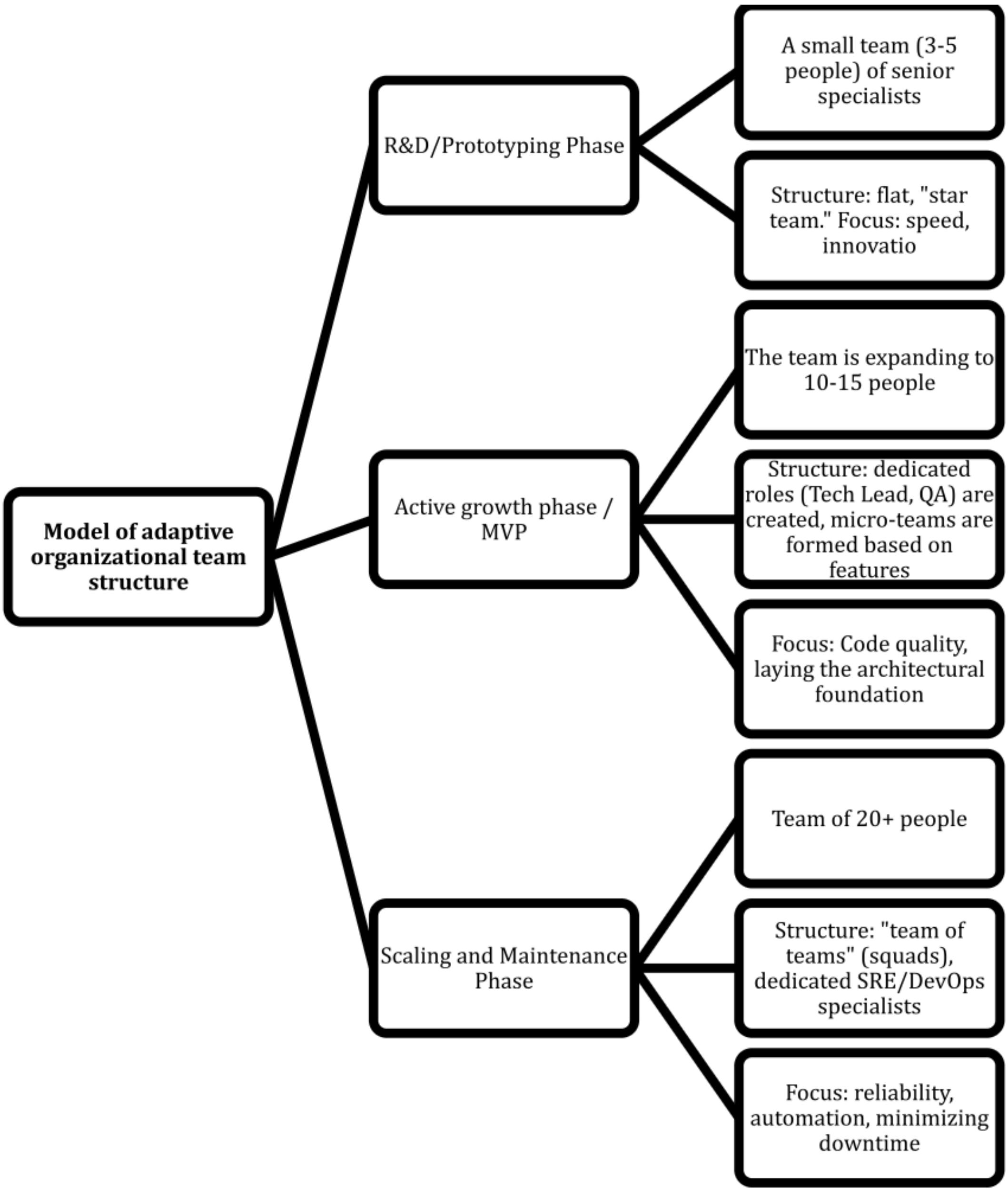

Figure 2: The adaptive organizational structure model of the team [6, 7, 9]

Such plasticity makes it possible to optimize resource allocation and minimize bureaucratization costs at early stages, and at subsequent stages to institutionalize stable governance frameworks and ensure operational reliability. At the same time, proactive management of risks arising from personnel decisions remains critically important.

Table 2: Matrix of personnel strategy risks and methods of their mitigation [1, 2, 10]

Risk	Probability	Impact	Mitigation strategy
Bus factor (loss of a key specialist)	Medium	High	- Distributed leadership: encouragement of knowledge sharing, pair programming. - Documentation: maintaining a knowledge base. - Mentorship programs: preparing successors.
Team technological burnout	High	High	- Innovation budget: allocation of time for refactoring and studying new technologies. - Rotation across projects/tasks. - Automation of routine tasks (CI/CD, IaaC).
Hiring a toxic employee	Low	High	- Multi-stage interview: with participation of several team members. - Behavioral interview: focus on soft skills. - Probationary period with clear evaluation criteria.

Finally, the proposed model cannot exist without a culture of distributed leadership. A hierarchy with a single all-knowing leader becomes the most vulnerable point as the team scales. In the proposed paradigm, Senior engineers act not as mere executors but as full-fledged owners of their subsystems: they mentor less-experienced colleagues and assume responsibility for technical decisions within their own domains. This mode of distributed leadership simultaneously strengthens team resilience and accelerates the professional development of all participants.

Taken together, the proposed integrated model — predictive recruiting, assessment based on the Competency Matrix, an adaptive organizational structure, and a culture of distributed leadership — constitutes a holistic response to the challenges of building engineering teams for high-load projects. It enables a transition from reactive practices to proactive, strategic management of the company's key asset — its talent.

5. Conclusion

Within the study, the objective was achieved: an integrated talent strategy is proposed for the design and development of engineering teams capable of sustainably delivering projects with high loads. The tasks set were carried out sequentially and in a logically coherent manner.

First, a critical review of contemporary scholarly literature revealed systemic limitations of traditional HR practices: their inertia, insufficient sensitivity to the specifics of high-load systems, and a shift of emphasis from designing a complementary, synergistic team to searching for universal soldiers.

Second, the profile of key competencies of engineers and leaders was refined. In addition to deep domain-technical expertise, architectural thinking, psychological stress resilience, and advanced communication skills acquire defining significance. The role of the technical leader is reinterpreted: from an operational manager to a strategist, mentor, and architect of a productive engineering culture.

Third, an original integrated model is proposed, including predictive recruiting (proactive work to anticipate talent gaps), a multidimensional competency matrix (objectifying the assessment and development trajectories of specialists), an adaptive organizational structure (coevolution of the structure with the project life cycle), and a culture of distributed leadership (increasing the team's resilience and scalability). Practical applicability is confirmed by the analysis of the Voka project case and the experience of managing a large IT department at Innowise.Thus, the author's hypothesis is verified: a proactive, flexible, and development-oriented talent strategy indeed ensures the formation of more effective and resilient engineering teams for projects with high loads. The presented model can serve as an applied guide for IT managers and HR professionals in building teams capable of creating and maintaining complex and reliable technological products.

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