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Role of Scholarships and Their Endowments in Developing Talents in Kazakhstan

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Abstract: The article analyzes the role of scholarship programs and endowment funds within the national system for identifying, developing, and retaining talent in Kazakhstan. The study situates this analysis within the context of global competition for human capital, focusing specifically on the STEM (Science, Technology, Engineering, and Mathematics) sector, where the state's capacity to build a highly qualified workforce becomes a prerequisite for economic diversification, reduction of resource dependence, and preservation of intellectual sovereignty, particularly in STEM segments. The scientific novelty lies in an attempt to reconstruct a holistic architecture of talent support through the interaction of three resources: government initiatives, private philanthropy, and targeted endowments. The research demonstrates how these mechanisms jointly form a personnel pipeline for high-technology sectors. The analysis addresses not only the volume of funding but also the institutional logic of resource allocation, the professional trajectories of recipients, and their alignment with the priorities of economic policy. The empirical section focuses on current financing models — from government grants to initiatives of private foundations, including Berik and Bayan Kaniyev Foundation and Fizmat Endowment Fund as representative cases of STEM support. Structural risks are examined separately: the gap between graduates' competencies and labor market demand, as well as gender imbalance in STEM. In conclusion, a hybrid model is proposed that integrates government programs, private charity, and sustainable university-level financial instruments, interpreted as the inception of a talent ecosystem. The materials are addressed to education policy researchers, university management teams, leaders of charitable foundations, and decision-makers in the sphere of human capital development.

Keywords: Kazakhstan, scholarships, endowment funds, talent development, STEM education, human capital, philanthropy, Fizmat Endowment Fund, Kaniyev Foundation.

Introduction

In the knowledge economy of the twenty-first century, human capital is the principal factor of states' long-term competitiveness, rather than merely material resources or access to natural wealth. Countries that have built systematic mechanisms for identifying, purposefully developing, and retaining highly qualified personnel form sustainable technological advantages and accelerate the modernization of their national economies. For Kazakhstan, which has declared a transition from a resource-extractive model to an economy based on innovation and high technologies, the issue of strategic investment in talent becomes not simply important but decisive. Of particular significance is the formation of human capacity in the fields of science, technology, engineering, and mathematics (STEM), since these spheres generate the greatest added value and constitute the foundation of technological sovereignty. At the same time, traditional measures of state support, primarily mass educational grants and other forms of universalized budgetary assistance, address the task of expanding access to education but do not provide targeted support for the most promising and gifted specialists. Under these conditions, the role of more flexible and sustainable financial mechanisms increases, such as targeted scholarship programs and endowment funds capable of ensuring long-term, individualized, and strategically calibrated financing of educational and research trajectories (Narbaev et al., 2025; Jonbekova, 2024)

This institutional development received a significant legal framework in 2025. In April 2025, the Parliament of Kazakhstan adopted the foundational Law 'On Target Capital Funds and Endowment Funds' (signed by the President in June 2025), which systematized the legal basis for the creation and operation of such funds. This legislation, in particular, draws on the author's practical experience as the head of the Fizmat Alumni Fund, which was implemented in organizations in this field, including the successful model of the Fizmat endowment fund.

The aim of the study is to analyze the role and effectiveness of scholarship programs and related endowment funds in the system of identification, support, and development of talent in the Republic of Kazakhstan, with an emphasis on the training and support of personnel in the STEM sector.

The scientific novelty of the study lies in the fact that, for the first time, the work undertakes an attempt at a systematic analysis of the role of private endowment funds as an institution that is still in the formation stage in the Kazakhstani context, linked to the tasks of the national strategy for training personnel in STEM. Unlike most existing studies that focus either predominantly on state programs of academic mobility and specialist training, in particular programs such as Bolashak, or on the general state of STEM education and science in the country, this work considers the issue of synergy. It analyzes not only each separate line of financing but also their possible coordination aimed at creating a unified contour of talent support, from early identification to retention and integration into the national economy.

The author's hypothesis is based on the premise that a full-fledged and effective national system for talent development in Kazakhstan cannot rely exclusively on direct state financing. To ensure a technological breakthrough and to form a core of personnel capable of generating innovation, a multilevel, hybrid architecture is required. In such a system, state scholarships perform the function of broad coverage by lowering barriers to entry and ensuring mass training of qualified specialists, whereas private, corporate, and targeted endowments, including the endowment operating on the basis of the National School of Physics & Math (aka Fizmat School), provide depth of support by ensuring targeted financing, flexibility, long-term horizons, and personalization of educational and research trajectories for the most promising students and young specialists. It is assumed that precisely the combination of mass state support and the elite targeted model of endowments creates the conditions for the emergence in the country of a stable stratum of top-class personnel in STEM, oriented not only toward academic achievements but also toward the creation of applied technological solutions.

Materials and Methods

The study is an analytical work grounded in a qualitative examination of secondary data. The methodological design comprises two key components: the targeted

collection and interpretation of empirical-analytical materials, as well as the application of theoretical and methodological procedures of analysis.

Sources were selected based on their direct relevance to the study's key analytical nodes, including higher education in Kazakhstan, STEM education, scholarships, endowment funds, talent development, philanthropy in education, and human capital. The source base was compiled through searches in academic bibliographic systems (Google Scholar, ResearchGate, MDPI) and through analysis of materials published by specialized organizations and research centers, such as the Eurasian Research Institute and the Nazarbayev University Research Portal.

To address the research tasks formulated in the introduction, a multi-component methodological apparatus was employed.

– Systems analysis was applied to consider scholarship programs and university endowments not as autonomous financial instruments but as elements of an interconnected ecosystem for the formation and retention of human capital. This approach enabled analysis of these instruments in their functional complementarity, from the identification and selection of strong students to the support of their professional trajectories.

– The comparative method was aimed at juxtaposing models of financing talent, conventionally divided into large-scale public mechanisms and targeted private or endowment initiatives.

– The case study method was used for a detailed analysis of the practical mechanisms of specific organizations, such as the Fizmat Endowment Fund and Berik and Bayan Kaniyev Foundation. The application of case studies made it possible to move from the abstract model of funds as drivers of talent development to a concrete governance architecture: sources of capitalization, mechanisms for selecting recipients of support, systems for accompanying talent, and the managerial motivations of donors. In this way, the case study performed a bridging function between the theoretical level and empirically observed managerial practices.

The method of synthesis and modeling underpins the Discussion section. Based on the compared data, an original hybrid model of a talent-support ecosystem was constructed, integrating public and private mechanisms, and a model of competencies of an innovation leader was proposed. The latter is interpreted as a normative profile of a graduate capable not only of mastering STEM competencies but also of converting them into entrepreneurial and science-and-technology initiatives.

Results

This section presents the results of the analysis of the current situation with talent development in Kazakhstan, focused on the STEM domain as the most indicative for identifying the role of scholarships and endowments.

Education in science, technology, engineering, and mathematics (STEM) today is not merely an important area of workforce training, but the infrastructure of states' economic survival amid global technological competition. It is precisely the STEM capital that ensures a country's ability to design and implement new materials, artificial intelligence algorithms, digital industrial solutions, and high-tech infrastructure. In the global agenda, STEM development is associated with the formation of knowledge economies resilient to commodity shocks; countries that build dense STEM ecosystems accelerate the growth of high value-added sectors and shape their own technological standards rather than merely importing others' solutions (Enhancing 21st-Century Skills, STEM Attitudes, and Career Interests Through STEM-Based Teaching).

In Kazakhstan, recent years have seen noticeably increased attention to STEM areas. An analysis of the dynamics of publications and research on STEM education issues shows that since 2019 there has been steady growth in scientific and expert interest in this topic. This indicates a heightened priority of STEM in national education policy and recognition of its strategic significance for economic modernization (Zhumabay et al., 2024).

At the same time, analytical reviews of the state of STEM/STEAM education in Kazakhstan emphasize that the system has not yet reached institutional maturity. Only a limited number of schools and educational programs have moved to integrated formats where mathematics, physics, engineering design, and creative disciplines (the art component of STEAM) are taught as interconnected elements of a single project-based activity (Kazimova et al., 2024). Most educational

organizations still operate within a linear paradigm of subject followed by test, rather than in the logic of an engineering problem solved by an interdisciplinary team of students. Insufficient ecosystem maturity manifests in systemic gaps.

First, there is a gap between graduate training and employment. The study Employment of STEM Graduates in Kazakhstan: Current Situation shows that although a significant share of STEM graduates subsequently find employment in their field, their proportion is smaller than that of the overall cohort of graduates, and a noticeable number of specialists are forced to work outside their direct specialty (Dmitrienko et al., 2023). This means that the education system produces competencies faster than the economy can absorb them in high-tech sectors. Second, a pronounced gender imbalance persists. In Kazakhstan, women remain underrepresented in engineering and technological professions, especially in high-paying industries (Kuchumova et al., 2024). At the same time, the situation is not unambiguously negative. Kazakhstan demonstrates a paradoxical picture: women actively enroll in a number of STEM majors at universities (especially in mathematics and the natural sciences), but their participation drops sharply at the intersection with high-paying engineering and further at leadership positions in knowledge-intensive industries. This indicates that the problem is not only to enter STEM, but also to remain in STEM with career progression.

The state is attempting to respond to the identified challenges through direct funding of schools, modernization of laboratory infrastructure, implementation of digital technologies, and updates to curricula (Education in Kazakhstan: Challenges, Reforms and the Road to Equity; The National Fund for Children in Kazakhstan: Policy Innovation and Potential for Global Impacts). Such measures undoubtedly create the necessary basic layer of infrastructure: computers, laboratory equipment, and connection to the olympiad and research movement. However, under rapidly changing technological requirements of the market, this is not sufficient. The issue is no longer only access to equipment, but the speed of adapting substantive learning pathways to real economic challenges.

This is precisely why private initiatives that can act faster and with greater precision are beginning to play an important role. Their contribution is not simply distributing grants to talented children, but creating holistic environments—ecosystems for selection, teaching, scientific socialization, and access to international networks. In essence, this is the cultivation of a talent pipeline for the country's future science and technology elites.

A revealing example is the National School of Physics & Math (aka Fizmat School), around which the Fizmat Endowment Fund was created. This fund is one of the first and most sustainably operating endowments for secondary education in Kazakhstan. Its fundamental feature is that a target capital is formed that is not spent directly: the base fund is accumulated through contributions from alumni, parents, and partners, and only the income from investing this capital is directed into the educational process. This approach ensures the school's financial sustainability for a generation ahead, and not only within a budget cycle. Endowment funds are used to attract top teachers, pay for students' participation in international olympiads in mathematics, physics, and informatics, update laboratories, and support students' research projects—that is, to form not merely academically successful graduates but bearers of an applied research culture. Moreover, the Fizmat Endowment Fund became a pioneer in the development of endowment in the country, inspiring the creation of other funds. Its structure and principles were adapted by newer philanthropic organizations, such as the Heart Center Foundation, and the founder provided advisory support for the creation of many similar funds in the future (Heart Center Foundation).

Importantly, international connectedness is forming around this model. Kazakhstan acts as the organizer of one of the region's notable olympiad platforms—the International Zhautykov Olympiad (IZhO), which brings together top school students in mathematics, physics, and informatics from different countries. This olympiad not only strengthens the brand of Fizmat and of Kazakhstan as a whole as a center of attraction for gifted students, but also creates horizontal links between specialized schools of different states, thereby increasing the capitalization of human contacts already at the upper-secondary level. Such a network is effectively a framework for talent export: the best students become embedded in the global olympiad and research community even before entering university.

At a broader level operates the Berik and Bayan Kaniyev Foundation (Berik & Bayan Kaniyev Foundation), which focuses on supporting education and creating educational elevators, including through its own scholarship programs and projects to develop school infrastructure. In 2025 the foundation announced a partnership with international universities (in particular, with the Fuqua School of Business at Duke University (Duke University's Fuqua School of Business)) to launch a scholarship aimed at supporting citizens of Kazakhstan applying to postgraduate (Master's) programs, specifically the MBA and other dedicated Master's degrees (e.g., MQM, Master of Management) at the Fuqua School of Business at Duke University. This is important in the context of STEM for two reasons. First, this is not merely financial assistance to an individual student, but the formation of a channel of access for Kazakhstani specialists to the world's leading management schools, where competencies in technological entrepreneurship and the management of complex innovation projects are built. Second, such scholarships demonstrate a transition from one-off charity to strategic philanthropy, where private capital purposefully fills the missing elements of the ecosystem—leadership, managerial expertise, global connections—which then return to the country in the form of human capital (Kazakhstan to Launch "School for Philanthropists" to Support Endowment Sector; The National Fund for Children in Kazakhstan: Policy Innovation and Potential for Global Impacts). In fact, endowments and funds of this type act as a parallel but complementary framework for the development of the national STEM and technology sector.

The key advantage of endowments like Fizmat lies in shifting the focus from formal degree attainment to the formation of reproducible competencies and research practices. They invest in skills that are in demand in the new economy: critical thinking, mathematical and engineering culture, the ability to decompose complex problems, work with data and digital tools, as well as the ability to operate in an environment of high uncertainty. In the global economy these skills are treated as the core of specialists' competitiveness in the twenty-first century, and the fact that they are beginning to be deliberately and systematically cultivated already at the upper-secondary level in Kazakhstan means shifting the entry point into high-tech industries to an earlier age (Enhancing 21st-Century Skills, STEM Attitudes, and Career Interests Through STEM-Based Teaching) .

The author's experience, who in the period from 2016 to 2023 was engaged in developing a number of STEM schools in Kazakhstan, confirms this. This involvement included both public flagships like RPhMS and direct participation in the creation and academic design of private initiatives, such as the Quantum STEM School. The author's work in designing their academic programs and operational models confirms that graduates of such schools demonstrate not only a higher theoretical level but also greater readiness to solve engineering and research problems in real rather than instructional-simulated conditions. They adapt more quickly to laboratory and project formats, integrate more easily into multilingual academic communication, and better understand the structure of the technological industries they are about to enter. This is not an olympiad elite in the narrow sense, but the seed of a talent base for applied science, engineering entrepreneurship, and the R&D segment of the economy.

The next necessary step is the institutionalization of international partnership. Kazakhstan is already moving in this direction: holding international olympiads (such as the Zhautykov Olympiad) creates stable academic ties among schools; participation of private funds in developing joint scholarship programs with leading foreign universities (the example of cooperation with Duke University and the Fuqua School of Business) forms channels for the export and re-import of competencies; attracting international mentors and experts as teachers and coaches for gifted students provides early access to advanced teaching methods and modern research practices.

It should be emphasized separately that international cooperation is also beginning to be used as a mechanism to overcome the gender gap in STEM. Initiatives supported by the UN, UNDP, and partners in Kazakhstan are increasingly focused not merely on attracting girls to science, but on creating role models, mentoring networks, and leadership programs for them in technical fields. These programs are specifically aimed so that girls not only enter engineering and IT tracks, but also remain in them, build careers, and reach managerial levels. Embedding such initiatives into the national STEM education system and the endowment infrastructure is not an optional task but a strategic

issue of long-term competitiveness (Zhumabay et al., 2024).

That is, it can be said that Kazakhstan is moving from point educational initiatives to the formation of a sustainable, multi-level ecosystem for training STEM talents. On the one hand, the state is strengthening infrastructure and funding. On the other hand, the private sector is building long-acting endowments and scholarship models, such as the Fizmat Endowment Fund and the programs of the Berik and Bayan Kaniyev Foundation, which directly invest in teachers, laboratories, access to international olympiads, and global academic trajectories.

Discussion

The analysis presented in the Results section records a systemic divide: in Kazakhstan there are already initiatives to support talented youth that demonstrate targeted effectiveness, yet they exist in a fragmented manner and do not form a unified contour for the reproduction of human capital. State mechanisms operate with a logic of mass coverage and provide basic access to educational and scholarship opportunities, but at the same time are characterized by limited adaptability to individual trajectories of talent development (Narbaev et al., 2025). In parallel, private endowment funds and targeted charitable structures operate — in particular, Fizmat Endowment Fund and Berik and Bayan Kaniyev Foundation — which demonstrate high precision in selecting and accompanying gifted students, including targeted support for the strongest students. However, such organizations operate predominantly in a format of bespoke work, which means that their scale and sustainability depend on limited resources and the will of individual donors, sharply narrowing the coverage of the potential talent pool. A qualitative overhaul of the system is required — a transition from a set of separate programs to the formation of a holistic talent ecosystem capable of accompanying a gifted person not episodically, but throughout the entire professional cycle: from school and university to the first managerial roles in industry.

In order for such an ecosystem not to be confined within national constraints and to reproduce world-class competencies, an international contour of cooperation is critically necessary. This concerns strategic partnerships with leading global academic centers, including the Fuqua School of Business at Duke University (USA), whose expertise is relevant not only in the field of business education but also in the institutional construction of infrastructures for developing leaders. It is essential to emphasize here: the task is not limited to sending Kazakhstani students to study abroad under models of academic mobility similar to practices (Jonbekova, 2024; Education in Kazakhstan: Challenges, Reforms and the Road to Equity). Much more significant is the import of managerial and educational technologies that can be localized within Kazakhstan along three interrelated directions.

First, professional endowment management practices must be established. National funds of

targeted capital — both at universities and specialized schools — are still at the stage of institutional formation and lack competencies in long-term asset management, balanced risk profiles, and income reinvestment policies. In American research universities (including Duke), such mechanisms have been refined over decades and serve not merely as a source of scholarships, but as a systemic financial instrument for the sustainability of educational and research programs. The transfer of such practices could provide Kazakhstani endowments with greater predictability of financing and reduce dependence on short-term donor inflows.

Second, emphasis should be placed on the development of soft skills. Graduates of STEM fields in Kazakhstan, even when demonstrating strong technical training, often prove insufficiently equipped with managerial, communication, and leadership competencies. The absence of these skills limits their ability to move from the role of executor of engineering tasks to the role of initiator and driver of technological solutions. International business schools form such skills as a mandatory component of the educational trajectory, and the transfer of this logic into local curricula is strategically significant not only for individual graduates but also for the formation of a stratum of technological managers.

Third, bridge programs should be created between Kazakhstani technical universities and foreign business schools following the model of STEM + MBA integration. Such hybrid trajectories can purposefully prepare future technological leaders — specialists who simultaneously understand the deep nature of the product and possess the tools of commercialization, team management, and

market entry. In the logic of national development, these programs serve as the missing link between the engineering school and the innovation economy.

Based on the analysis of cases and the identified institutional deficits, an original hybrid model of the ecosystem is proposed (see Figure 1), within which the resources of the state, private funds, and international partners do not compete but complement each other. Structural integration is envisaged as mass state programs (as an instrument of scalability), highly selective private initiatives (as an instrument of quality and depth in supporting individual trajectories), and internationally translatable managerial and educational practices (as an instrument of standard and reproducibility. Such an ecosystem is capable not only of identifying and supporting talent in the academic environment, but also of guiding it through the critical transition to the market, thereby reducing the recorded gap between the training of STEM specialists and their professional realization (Dmitrienko et al., 2023).

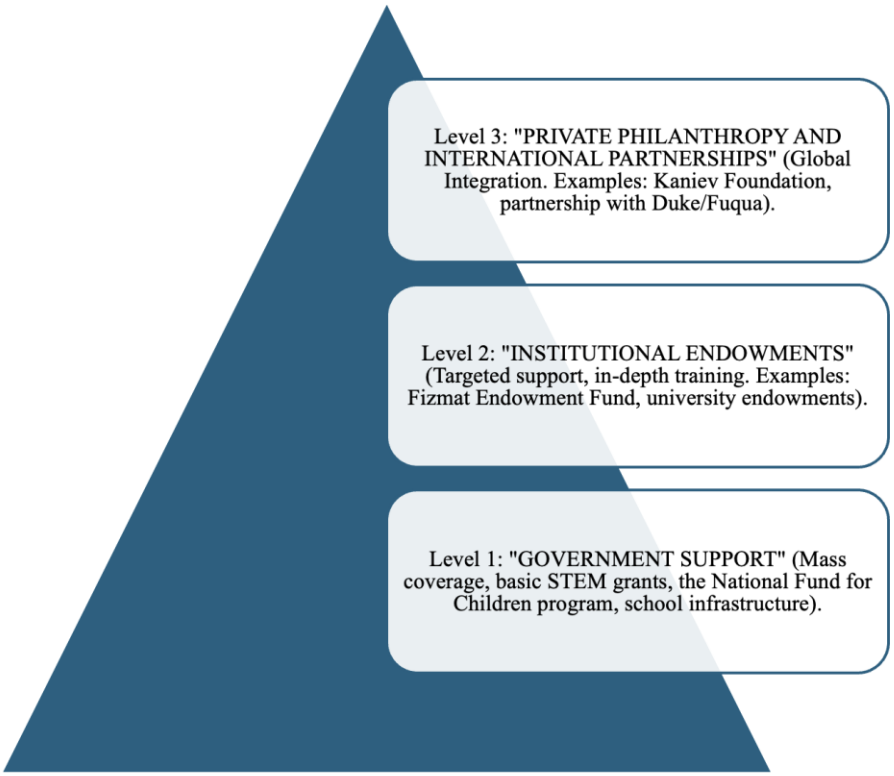

Figure 1. Hybrid model of the talent support ecosystem in Kazakhstan (adapted from the framework presented in Dmitrienko et al., 2023)

This model shifts the emphasis from fragmented support for gifted students in the form of separate scholarships to systemic, long-term accompaniment of the trajectory of talent development. The logic is constructed as an end-to-end chain of institutions: the state creates the widest possible selection base — the so-called wide funnel — providing mass access to the early identification of potentially strong students; next, institutional endowments carry out the selection of the most promising candidates and provide their targeted, in-depth training; at the final stage, private foundations act as a mechanism for capitalizing this human potential, opening access to international educational and research opportunities, as well as ensuring the subsequent inclusion of these specialists in economic circuits of high complexity and added value.

To capture the fundamental differences between support models, it makes sense to conduct their comparative analysis (see Table 1).

Table 1: Comparative analysis of talent financing models in Kazakhstan (Berik & Bayan Kaniyev Foundation; Duke University's Fuqua School of Business; Public Fund "Fizmat Endowment Fund"; The National School of Physics and Mathematics (aka Fizmat School) and the Republican Scientific and Practical Center "Daryn")

Criterion	Government scholarships (Grants, Bolashak)	Institutional endowments (Fizmat Endowment Fund)	Private philanthropic foundations (Kaniyev Foundation)
Source	State budget	Endowment capital (alumni and corporate donations)	Private capital (founders)
Primary objective	Ensuring mass access to higher education	Long-term sustainable development of a specific educational institution (National School of Physics & Math)	Support for talent in fund-selected fields (STEM, education)
Flexibility	Low (standardized requirements, reporting)	High (decisions made by the Board of Trustees)	Very high (direct decision of founders/board)
Focus	Wide coverage (thousands of grants)	Depth (grants for teachers, olympiads, laboratories)	Precision honing (personal scholarships, internships)
Time horizon	Short term (1 year) / Medium term (4 years)	Long term (perpetual investing)	Medium term (according to the foundation's strategy)

As comparative analysis shows, none of the mechanisms presented, in isolation, is capable of addressing the full range of tasks related to developing and retaining human capital. Public programs possess scale and stable financing; however, their institutional nature renders them rigid and slow to adapt to evolving technological and workforce demands (Narbaev et al., 2025). By contrast, private foundations are characterized by high managerial flexibility, rapid decision making, and the ability to target investments toward specific development trajectories, but they are unable to achieve coverage comparable to national systems and are structurally not designed for scale.

The proposed hybrid architecture bridges the gap between these levels. It envisions a continuous, seamless transfer of talent between state institutions of early selection, targeted educational and research centers for advanced training, and private foundations responsible for international legitimation and subsequent professional integration. Such an end-to-end support loop accompanies the individual at all key stages of the educational and career trajectory, minimizing talent losses at transitions between system levels while simultaneously increasing returns on the investments in them (see Figure 2).

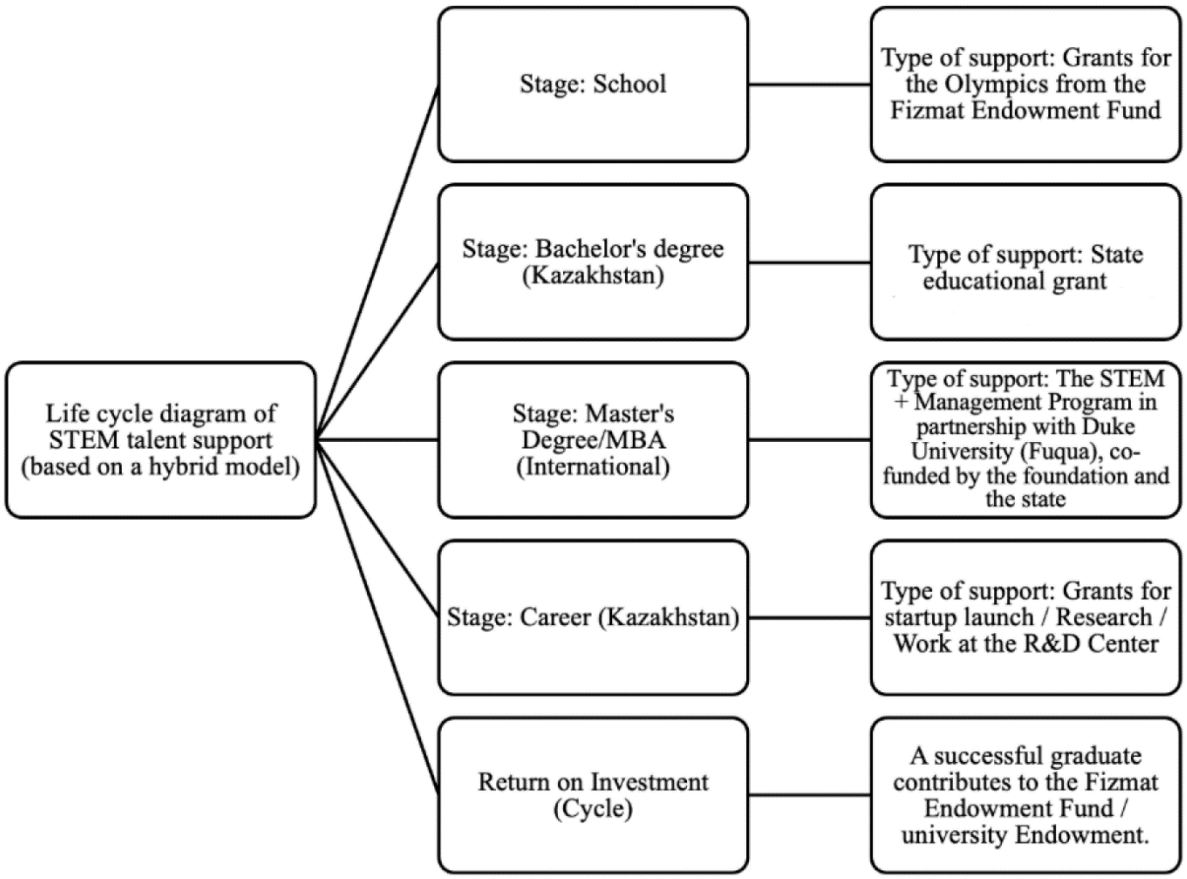

Figure 2. Life cycle diagram of STEM talent support (based on a hybrid model) B&B Kaniyev Scholarship is for masters' programs at Duke Fuqua School of Business only.

This scheme shows that the role of scholarships and endowments can and should extend beyond mere financial support for education. These instruments can function as elements of strategic management of a specialist's formation trajectory: from detection and selection to the stage of professional integration. In this understanding, a scholarship ceases to be a one-off measure of student support, and an endowment is no longer merely a source of targeted financing for an educational organization; together they form a governed trajectory of competency development, which makes it possible to specifically address the structural problem associated with the desynchronization between the training system and actual market demands (Dmitrienko et al., 2023).

In other words, the point is that financial mechanisms are transformed into institutional mechanisms of guidance and completion: they not only support the academic progression of talent, but also deliberately align its vector toward current economic niches, shortening the lag between the learning phase and the phase of in-demand employment.

Thus, it can be said that scholarship mechanisms and endowment funds in Kazakhstan are evolving from a format of social support to the role of a strategic instrument in the competition for human capital. They are beginning to operate as an element of national technology policy, rather than as a charitable option. The prospective development trajectory consists in the institutionalization of a coordinated hybrid ecosystem in which government bodies, schools, universities, and private foundations act not fragmentarily, but as a coherent circuit for the reproduction and retention of talent within the country.

Conclusion

Summing up, the study demonstrates that for Kazakhstan the shift from fragmented measures to support the gifted toward a coherent ecosystem of talent in STEM is a prerequisite for technological sovereignty. Relying on qualitative analysis of secondary data and cases (Fizmat Endowment Fund, the Berik and Bayan Kaniyev Foundation), the research shows the complementarity of three tiers: mass public grants (broad coverage), institutional endowments (long

horizon and depth of individualized support), and targeted private philanthropy (flexibility and fine-tuning of trajectories, including international master's and MBA routes). Such a hybrid architecture builds a through pipeline — from early selection and olympiads to research projects, entrepreneurship, and managerial roles; at the same time it addresses two systemic risks — the mismatch between competencies and market demand, and the gender gap in engineering and technological careers.

The practical novelty lies in proposing a governable model of integration: standardizable management of dedicated capital (endowment management), embedding soft skills and leadership into STEM curricula, creating bridge programs in the STEM+MBA format, and expanding international partnerships as a mechanism for importing managerial and educational technologies. The conclusion is clear: merging the scale of the state with the selective depth of endowments and funds moves scholarships from the sphere of social support into the toolkit of national technology policy.

Future directions include institutionalizing harmonized rules and metrics (career outcomes, the share of in-field employment, women's leadership in STEM), the development of which will ensure reproducibility and sustainable financing of the ecosystem over a generational horizon.

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