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Human Resource Management in Biotech and DeepTech Startups - the Pilot Study

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Abstract

Startups are important drivers of innovation and economic transformation. Biotech and DeepTech sectors are particularly significant, requiring deep scientific insight, advanced education, and robust support systems to translate high-tech breakthroughs into market-ready applications. Unlike established corporations, startups operate under conditions of high uncertainty, limited resources, and rapid development. Their success depends not only on technological advancement and access to capital but also on effective human resource (HR) management tailored to early-stage dynamics. This paper presents a structured review of academic literature, reports, and case studies from the past fifteen years (2010–2025), complemented by a pilot consultation reflecting the Czech and broader Central and Eastern European (CEE) context. It analyses key dimensions of HR management in Biotech and DeepTech startups, including leadership, talent acquisition and retention, interim management, and the role of support infrastructures such as incubators and accelerators. Particular attention is given to the challenges of attracting specialized talent, building interdisciplinary teams, and bridging cultural differences between science and business. The findings highlight the importance of visionary and adaptable leadership capable of navigating complex regulatory and organizational environments, as well as the contribution of interim managers, business angels, and early-stage investors who help fill strategic HR gaps and provide mentoring. Additionally, the study aligns with European policy frameworks promoting gender equality and HR capacity-building. Supported by literature-based evidence and region-specific insights, the paper offers recommendations for founders, investors, and policymakers, concluding that strategic HR management is a critical factor for long-term competitiveness of innovation-driven ventures.

Key Words: Startups, DeepTech, Human Resource, Leadership, Interim Management

JEL Classification: M12, M13, O32

Introduction

Startups belong to key drivers of technology transfer and innovation, significantly influencing economic growth and technological advancement (Cohen, 2014; Dealroom,

2023). Unlike traditional established corporations, startups operate in environment with significant uncertainty, rapid growth, and highly limited resources. The success of startups is highly influenced by effectiveness of a human resource management (HRM) and its impact on team dynamics, leadership, and talent retention (Mahadevia, 2014; Van Scheijndel, 2020). Operating at the intersection of science, technology, and business, DeepTech and Biotech startups aim to develop disruptive solutions that challenge existing markets or create entirely new ones. According to the European Commission (Dealroom, 2023), startups typically exhibit high growth potential, a global outlook, and a strong emphasis on technological and digital innovation.

Unlike traditional businesses, startups are defined by their ability to quickly adapt strategies and processes, while building scalable business models. As Ries (2011) notes, a startup is a temporary organization designed to search for a repeatable and scalable business model through iterative experimentation and feedback-driven learning. Particularly within the fields of Biotech and DeepTech, startups face unique challenges and opportunities that stem from long development cycles, high research and development costs, and a strong reliance on academic-industry collaboration and technology transfer (Van Rooij, 2023; MIT REAP, 2022).

European policy frameworks, such as Horizon Europe and the European Innovation Council (EIC), increasingly emphasize gender equality and HR capacity as drivers of innovation. Measures such as the mandatory Gender Equality Plan (GEP) for Horizon Europe applicants and targeted initiatives like Women TechEU, which supports women-led deep-tech startups, underline that HR strategies also intersect with compliance and funding eligibility (European Commission, 2023; EIC, 2024).

Against this background, this study investigates HRM strategies that enable Biotech and DeepTech startups to address organizational and ecosystem-level challenges. It focuses on leadership dynamics, talent acquisition and retention, interim management, and the role of support infrastructures such as incubators and accelerators. While the literature review adopts an international perspective, preliminary findings were validated through a pilot consultation reflecting the Czech and broader Central and Eastern European (CEE) context. This combined approach offers both a conceptual framework and region-specific insights, aiming to inform best practices for founders and investors as well as policy recommendations to strengthen innovation ecosystems.

1. Methods of Research

This study consists of a literature review analysing academic papers, industry reports, and case studies related to human resource management (HRM) in Biotech and DeepTech startups. The literature was systematically searched using academic databases including Scopus, Web of Science, and Google Scholar, focusing primarily on contributions published between 2010 and 2025, with particular emphasis on recent research from the last five years.

To complement the literature review, preliminary insights were validated through a pilot consultation with three seasoned professionals offering diverse ecosystem perspectives: a general partner of a DeepTech/ Biotech fund (**VC fund perspective**), an institutional LP representative (**banking and financial sector**), and a Biotech startup CEO (**individual startup perspective**). Semi-structured interviews (**45–60 minutes**) explored HR challenges, talent dynamics, and interim leadership needs. This pilot captured strategic viewpoints and provided qualitative validation of the literature findings. Their insights reflect the perspective of the Czech innovation ecosystem and, to some extent, broader CEE region. A broader stakeholder survey is planned in the next research phase to enhance generalizability.

The key areas of focus include:

1. Challenges for DeepTech and Biotech Startups
2. The role of leadership and HR management in startup success.
3. Talent acquisition and retention strategies in highly specialized sectors.
4. The impact of interim management in bridging managerial gaps.
5. The effectiveness of external support: incubators, accelerators, and venture capital in HR strategies.

A qualitative analysis was conducted to synthesize insights and identify patterns that contribute to the scalability and sustainability of Biotech and DeepTech startups.

2. Results of the Research

2.1 Challenges for DeepTech and Biotech Startups

Management of startups includes a wide range of challenges critically shaping their trajectory, moreover, additional complexity is observed in high-tech fields like Biotech and DeepTech. Financial uncertainty is among the most pressing issues, as early-stage ventures often require significant investment in product development while revenue or profit is usually not generated before exit. These startups are typically dependent on external funding provided by investors or non-dilutive public support, which demands credible business models and clear paths to return on investment (**Ries, 2011; Van Rooij, 2023**). Regulatory demands on newly developed products, especially in sectors like pharmaceuticals and medical technologies dramatically increase needed resources and timelines for innovative products marketing. To obtain approvals from bodies such as the FDA, EMA or MDR notified bodies can be time-consuming and expensive (**Franco, 2025; Martjan, 2025**). In addition, attracting and retaining relevant highly experienced staff and top-tier talent is increasingly difficult due to intense competition with established firms and the limited financial resources of young startups (**Scheijndel, 2023**).

Beyond regulatory challenges, many startups introduced in less mature ecosystems such as Central and Eastern Europe usually struggle due to limited access to experienced founders, serial entrepreneurs, and professional management. A lack of practical know-

how in areas like fundraising, international expansion, and product development can limit growth potential (Xiao, 2024; Chahine et al., 2020).

Another critical challenge lies in human resource management, which in startup settings differs significantly from established companies. DeepTech and Biotech startups typically operate in high-uncertainty environments with limited resources and fast-changing team structures. Unlike corporates with formalized HR systems, these startups must build effective teams quickly, often by combining diverse skill sets from scientific, technical, and commercial domains (Watson, 2025). This requires not only targeted talent acquisition, but also strategic decisions about team structure, leadership roles, and culture-building from the earliest stages. HR in these startups must balance flexibility with long-term planning, especially as they transition from small, informal teams to structured organizations. Managing this evolution effectively (including the onboarding of experienced external leadership, handling interdisciplinary collaboration, and fostering retention) is essential for sustained innovation and growth (NeSmith, 2024; Mahadevia, 2014).

These constraints underline a key insight: startup success depends not only on breakthrough ideas or technological innovations, but also on the ability to navigate complex financial, regulatory, and human capital hurdles. This is particularly true for Biotech and DeepTech ventures, where risk, timelines, and resource requirements are inherently greater.

2.2 Leadership in Startups

Leadership plays one of the most crucial roles in startup success, especially in complex and high-tech fields such as Biotech and DeepTech. Unlike in traditional corporates, startup leadership demands rapid decision-making, adaptability, and the ability to inspire teams under high uncertainty and limited resources (Ries, 2011). Successful startup leaders show visionary thinking, resilience, and a hands-on approach to deliver expected outcomes (McKinsey & Company, 2024). In science-driven ventures, leaders should be able to bridge the cultural and communication gap between research-oriented teams, investors and business stakeholders. These challenges require strong interpersonal skills, adaptability in strategic decision-making, and the capacity to operate effectively even when information is incomplete or evolving (Van Scheijndel, 2020; Gloor, 2011; Reynolds, 2024).

A common dilemma is whether startups should remain founder-led or transition to professional management as they grow. Founders often bring passion and deep technology insight but may lack experience in business development and scale-up activities, managing operations, or navigating relationships (Chahine et al., 2020). Interim management could be one of interesting solutions, allowing startups to temporarily onboard experienced executives for critical phases like fundraising, international expansion, or restructuring before upcoming financing round (Mochnacz, 2023; Van Rooij, 2023) as well as overpass lack of regulatory expertise (Martjan, 2025). This approach offers startups strategic expertise, agility, and knowledge transfer without long-

term cost commitments (Mulder, 2020). In Biotech and DeepTech startups, leadership must also contend with long R&D cycles, strict regulatory pathways, and interdisciplinary teams, which require exceptional coordination skills and communication capabilities (MIT REAP, 2022; Xiao, 2024).

In addition, leadership diversity is getting to be recognized as a performance driver including diversity by gender, background, or cultural perspective. Diverse teams are associated with more robust decision-making and innovation (Hughes, 2024). Inclusive organizational cultures belong to supportive aspects especially in science-based ventures, where both scientific excellence and commercial impact should be valued. Ultimately, strong leadership in startups is not only about vision but also about navigating complex ecosystems, integrating different mindsets, and continuously aligning purpose, people, and performance (McKinsey & Company, 2024; Fabian, 2024). These leadership qualities become even more critical given the reliance on external stakeholders for funding and strategic alignment in Biotech and DeepTech ventures.

2.3 Interim Management and Support Infrastructure

With respect to the importance of leadership outlined above, many startups (especially those in Biotech and DeepTech) face significant limitations in leadership capacity and operational expertise, particularly during critical stages of growth and transformation. One of the valuable solutions could be an interim management allowing companies to temporarily engage experienced professionals to bridge gaps in leadership, regulatory knowledge, or business development. Hired interim leaders could provide strategic input, oversee key transitions such as scaling or restructuring, and could be crucial to improve trust of investors. Furthermore, these positive effects do not require long-term commitments and financial liability before companies are able to hire experienced staff (Mochnacz, 2022; Mulder, 2020). As noted by Mochnacz (2023), interim managers are particularly effective in helping early-stage startups navigate uncertainty and align teams with evolving business needs.

In parallel, the broader startup support ecosystems and infrastructure plays a complementary role in addressing capability gaps and facilitating startup growth (Cohen, 2014). It could consist of venture -building incubators, supportive accelerators, and early-stage investors or business angles, who are able to support companies with a hands-on approach. These individuals and platforms usually offer structured programs focused on business planning, legal and regulatory support, mentorship, and access to networks and associated investors. The importance of such support is magnified in highly technical sectors, where specialized resources such as laboratories, compliance expertise, and academic-industry partnerships are often essential for progress (Van Rooij, 2023). Business angels, as highlighted by Lange et al. (2024), contribute not only early-stage capital but also strategic guidance and operational know-how. Angles often act as interim managers themselves, serving as board members, or chairs, supporting strategic targeting and leadership or supporting significant hiring decisions. In this perspective, supportive infrastructure including angel investors can significantly strengthen HR strategies and act as a de-risking mechanism.

Taken together, interim executives, startup infrastructure, and engaged investors form a synergistic ecosystem that reinforces leadership capacity and organizational resilience. For

Biotech and DeepTech startups, this combination helps mitigate key risks associated with talent shortages, knowledge gaps, and regulatory complexity—challenges that are often more pronounced than in other sectors. As such, effective use of interim management and support mechanisms can significantly improve the odds of sustainable scaling and long-term success.

3. Discussion

The findings presented in this study highlight several key dimensions of effective human resource management (HRM) in Biotech and DeepTech startups. These include the importance of visionary leadership, strategic use of interim management, and the enabling role of supportive infrastructure and engaged early-stage investors. In summary, these elements form a synergistic framework that helps startups navigate common constraints, including limited resources, regulatory complexity, and talent shortages, which are particularly pronounced in high-tech sectors. To make these findings more accessible for both academic and practitioner audiences, the key HR success factors identified in this study are summarized in Table 1. These factors synthesize literature-based insights and practical perspectives into an actionable framework for Biotech and DeepTech startups.

The table illustrates how leadership, interim management, talent strategies, and ecosystem support collectively contribute to startup resilience and scalability. These dimensions are not isolated but interdependent, reinforcing the need for integrated HR strategies that combine internal capabilities with external resources.

To preliminarily validate the relevance of these factors within a Czech and CEE context, a pilot stakeholder consultation was conducted with three seasoned professionals representing diverse ecosystem perspectives:

- a general partner of a DeepTech/Biotech fund (venture capital perspective),
- a representative of an institutional limited partner (banking and financial sector),
- and a CEO of a Biotech startup in the CEE market.

Despite the small sample size and exploratory nature of the consultation, the feedback broadly supported the study's key conclusions:

1. HR related challenges are among the most critical barriers to scaling DeepTech and Biotech startups.
2. Interim management could be seen as a practical and cost-effective way to bridge leadership and execution gaps in key stages of growth.
3. Supportive infrastructure, mentorship and early-stage investor support could (in perspective of responders) increases the likelihood of a long-term success of startups.

Tab. 1: HR Success Factors for Biotech and DeepTech Startups

HR Success Factor	Why It Matters	Implications for Startups
Visionary & Adaptive Leadership	Startups require leaders who can align science, business, and investor expectations under uncertainty.	Essential for navigating long R&D cycles, regulatory hurdles, and interdisciplinary teams.
Strategic Use of Interim Management	Bridges critical capability gaps during growth, funding rounds, or regulatory preparation.	Offers cost-effective expertise and boosts investor confidence without long-term commitment.
Effective Talent Acquisition & Retention	Attracting specialized talent is difficult due to competition and limited resources.	Requires creative incentives (equity), mission-driven culture, and strong onboarding practices.
Breaking Down Silos	Cultural gaps between scientists, business teams, and investors slow decision-making.	HR policies should foster cross-functional collaboration and communication early on.
Leveraging Support Infrastructure	Incubators, accelerators, and innovation hubs provide expertise, labs, and mentorship.	Reduces cost of scaling and improves access to compliance/regulatory knowledge.
Investor & Business Angel Engagement	Early-stage investors often add strategic HR guidance beyond capital.	Use investors as mentors, board members, or even interim managers during scaling phases.
Diversity in Leadership & Teams	Diversity drives creativity, resilience, and innovation capacity.	Encourage inclusion in gender, cultural background, and skills to strengthen team adaptability.
Culture & Organizational Development	Early HR systems influence long-term scalability and stability.	Founders should prioritize building values, trust, and feedback culture from the outset.

Source: authors

These findings also align with European innovation policies, which increasingly embed HR capacity-building and diversity into their funding frameworks. For example, Horizon Europe requires applicants to implement a Gender Equality Plan (**GEP**) as an eligibility criterion, while the European Innovation Council (**EIC**) promotes diversity by targeting at least 40% participation of women-led startups in pitch interviews and ensuring gender balance in evaluation panels. Initiatives such as Women TechEU further provide financial and mentoring support to women-led deep-tech ventures (**European Commission, 2023; EIC, 2024**). Incorporating these dimensions into HR strategies may enhance both organizational competitiveness and access to EU funding.

These pilot insights suggested that the core assumptions of this study are aligned with practitioner realities in the Czech startup environment. However, further and more comprehensive research is needed to understand regional specificities in HRM practices, ecosystem maturity, and institutional support. A broader survey or comparative case study approach across multiple CEE regions could provide more robust evidence base and

help tailor policy tools and support programs more effectively. This discussion sets the stage for translating insights into actionable strategies, both for startup practitioners and policymakers.

Conclusion

Biotech and DeepTech startups face a unique set of human resource challenges that significantly affect their long-term viability and competitive positioning. This study identified several strategic approaches that can help overcome these challenges and strengthen startup performance in the face of uncertainty and complexity. Leadership and management development: Scientifically oriented founders often lack experience in people management, business development, and organizational growth. Training programs provided by universities, incubators, and innovation hubs should focus on upskilling founders in leadership, strategic thinking, and cross-functional collaboration.

Interim management as a flexible solution: Engaging experienced interim managers enables startups to address specific organizational bottlenecks during critical growth phases. These professionals also facilitate knowledge transfer, team alignment, and investor confidence—without requiring long-term contracts.

Leveraging support infrastructure: Technology parks, incubators, and accelerators offer essential resources for early-stage startups. Their ability to provide legal, regulatory, financial, and strategic support is crucial for helping startups transition from early development to scalable operations. Strategic involvement of early-stage investors: Beyond providing capital, investors often contribute to HR strategy, governance, and mentoring, improving startup resilience and growth potential.

Promoting diversity in leadership and teams: Startups that embrace gender, cultural, and disciplinary diversity benefit from broader perspectives, stronger team dynamics, and improved innovation capacity. Diversity should be seen as both a social priority and a strategic advantage. This study provides an initial framework for understanding the strategic value of HRM in DeepTech and Biotech startup ecosystems. Future research should focus on validating these findings in broader regional contexts, exploring longitudinal effects of leadership transitions, and identifying high-impact interventions that enhance team resilience and talent retention across the startup lifecycle.

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