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From lab coats to CEO chairs: the dynamics of university spin-off teams

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Abstract

University spin-offs (USOs) play a crucial role in advancing innovation and regional economic development by transforming academic research into commercially viable technologies. Despite their potential, many USOs face developmental challenges due to limited business expertise, resource constraints, and overemphasizing technical competencies. While previous studies have highlighted the importance of team composition in USO success, there is limited understanding of how team structures must evolve across different growth stages to achieve sustainable returns.

This thesis addresses this gap by exploring the research question: *How does team composition evolve as University Spin-Offs (USOs) progress from their founding toward the sustainable returns phase?* Grounded in the Vohora et al. (2004) development model, this study investigates the dynamic evolution of team composition across various development phases, focusing on growing towards a viable and sustainable company

A qualitative, exploratory methodology was employed, consisting of ten semistructured interviews with founders and key stakeholders from Dutch USOs, supplemented by secondary data including academic backgrounds and team structures. The Gioia method was used for data analysis to distill first-order insights into thematic patterns and overarching dimensions.

The findings reveal that USOs typically begin with technically focused founding teams, rooted in academic environments, which limits their early commercialization capacity. Over time, successful USOs strategically evolve their teams by integrating entrepreneurial, managerial, and market-facing competencies. Key patterns include the emergence of championing competence, increased role specialization, and dynamic balancing of technical and commercial capabilities. The research also shows how external stakeholders such as Technology Transfer Offices (TTOs), incubators, and investors shape team evolution and strategic direction.

This study contributes to theory by enriching the USO development literature with a practical team-evolution lens, and to practice by offering actionable insights for founders, support systems, and policymakers. It highlights the need for USOs to proactively align team composition with their developmental stage, especially as they transition from opportunity recognition to market credibility and long-term sustainability.

Limitations include the qualitative scope and regional focus on Dutch USOs. Future research could expand cross-national comparisons and explore longitudinal team development using mixed methods. Nonetheless, this study provides a structured framework for understanding and supporting USO team's evolution toward sustainable success.

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1 Introduction

Successful University spin-offs (USOs) have the potential to generate jobs and spur local and national economies, growth, and knowledge (Hayter, 2013; Wright et al., 2004) by generating new firms and developing innovative technologies and processes (Hasche & Linton, 2021; Padilla-Meléndez et al., 2020). These ventures are formed to commercially exploit research results, knowledge, or technology developed within a university (Pirnay et al., 2003). Research shows that USOs leverage innovative potential to transform academic findings into practical applications, thereby advancing sectors such as biotechnology, healthcare, and technology (Lubik et al., 2013; Rasmussen et al., 2011). For example, IamFluidics is transforming the biotechnology sector by pioneering advanced microparticles, which have significant applications in pharmaceuticals and nutrition. Similarly, Chiron is revolutionizing on-chip biotechnology, contributing to the reduction of animal testing through innovative testing platforms. In the technology sector, USOs like SuperLight Photonics are pushing the boundaries of laser technology by enhancing the versatility and accessibility of supercontinuum lasers for broader commercial use.

While USOs hold strong potential for economic impact, they often face challenges that limit their growth. Many remain small-sized businesses and struggle to achieve the success levels of their non-academic counterparts, especially in Europe (Ensley & Hmieleski, 2005; Mustar et al., 2008). Due to the innovative nature of the USOs, they generally encounter higher complexities and risks. These challenges can hinder the USO growth and even lead to failure (Mueller et al., 2012). When USOs fail, the potential for generating and transferring novel innovation to the market is lost, impacting the region's ability to benefit from these advancements (Vivona et al., 2023). Furthermore, when USOs fail, it can disrupt the growth of entrepreneurial ecosystems that depend on knowledge spillover and successful ventures to encourage new business activities (Donaldson, 2021; Guerrero et al., 2021). Beyond the economic effect, these failures also mean that important new technologies in areas like biotechnology and healthcare or technology may never reach the market, slowing progress in the named fields (Rasmussen et al., 2011).

USOs are often constrained by their limited access to capital, human resources, and technical expertise, which limits their ability to navigate through the different development phases identified Vohora et al. (2004). Limited access to these resources is particularly challenging for USOs, as they generally develop high-tech solutions that are highly resource-intensive, especially during the early phases of development (Gbadegeshin, 2017). Another USO-specific constraint is the challenge of managing multiple stakeholders with diverse interests. They often need to align the expectations of the university, researchers, investors, and industry partners who may have very differing objectives regarding the commercialization of the technology (Rasmussen & Wright, 2015). Since USOs operate in highly challenging business environments and have to overcome the barriers to growth, strong managerial capabilities become essential for their success and growth potential (Vohora et al., 2004). However, Clarysse and Moray (2004) highlights that USOs often struggle with this due to their founders' lack of commercial and business insight. Toledano et al. (2022) adds to this by stating that poor management is a key factor limiting USO growth, as technical skills dominate while entrepreneurial and managerial competencies are underdeveloped.

According to Heirman and Clarysse (2007), the growth of USOs has been associated with a balanced, heterogenous team composition at the starting phase, meaning that teams should have a complementary mix of skills and an optimal size. These teams

are key determinants of growth due to their ability to adjust to complex environmental challenges that they are confronted with. Heterogeneous teams can adjust since they consist of a combination of technical and commercial expertise. However, as USOs grow, changes in team composition become necessary. Vanaelst et al. (2006) found that different stages of USO growth require different team structures. For example, in the early stages, the USO will mainly consist of researchers, but when the company is formed, entrepreneurs come into play to bring business experiences.

Given that USO founding teams should consist of individuals with heterogeneous skills, it might seem that larger teams are preferable. In bigger teams, roles can be distributed more effectively, allowing for specialization and refined task execution (Vanaelst et al., 2006). However, larger teams also face higher risks of conflicts and coordination challenges, including situations where multiple team members focus on solving the same problems, leading to inefficiencies (Clarysse & Moray, 2004; Vanaelst et al., 2006). In contrast, smaller teams are often the preferred choice for USOs, primarily because new ventures operate with resource constraints, making it financially unfeasible to hire a large team from the outset. Additionally, smaller teams tend to be more agile, which is essential in the rapidly changing environment of early-stage ventures (Colombo & Piva, 2012). However, founding teams that are too small may lack the necessary expertise and diverse competencies required to navigate commercialization challenges effectively. Therefore, it is crucial to build a team with the right balance; neither too large nor too small. According to Clarysse and Moray (2004), an ideal startup team consists of three to four members, ensuring sufficient diversity in skills while maintaining agility and efficiency.

While heterogeneous teams with a mix of technical and commercial skills provide a strong foundation, growth often requires specialized entrepreneurial competencies. Diving deeper into this aspect, Rasmussen et al. (2011) identified several distinct entrepreneurial competencies that are crucial for the successful development of USOs. Their study highlights three crucial competencies: Opportunity refinement, leveraging, and championing. While founders typically possess strong technical competencies due to their academic backgrounds, entrepreneurial skills are often lacking and must be developed or acquired.

While literature highlights the importance of team composition in USO success, it offers limited insight into the specific team requirements for achieving sustainable returns, as proposed in the *USO development model* by Vohora et al. (2004). In this phase, USOs need not only technical and operational strength but also strong market engagement and financial stability. Achieving sustainable returns requires a carefully structured team with the right mix of competencies and roles to support long-term profitability and growth. Understanding these team requirements is essential for helping USOs reach sustainable impact but is not yet fully understood.

To address this gap, this study poses the following research question:

How does team composition, evolve as University Spin-Offs (USOs) progress from the start toward the sustainable returns phase?

This study will guide an exploration of how USOs can strategically adapt their teams and capabilities to successfully navigate the path from start to sustainable returns. By identifying the team composition necessary at each stage, this research aims to provide actionable insights for USO founders and USO support systems to overcome the developmental challenges that USOs generally face. Building on this focus, the study offers contributions to multiple stakeholders, including scholars, practitioners, and policymakers, which are detailed in the following section.

Contribution to scholars: This study extends existing research on USO development by examining the evolution of team composition as USOs progress through different growth stages. Building USO development literature, this study provides empirical insights into team dynamics across critical transition phases. By doing so, it contributes to the broader entrepreneurial team composition literature, offering a deeper understanding of how teams adapt to commercialization challenges.

Contribution to practitioners: For USO founders, this study offers practical guidance on structuring teams to meet the evolving demands of each growth stage, specifically, it highlights the transition from the research phase to later commercialization stages, offering actionable insights into the optimal balance of technical, managerial, and entrepreneurial skills needed for sustainable growth.

Contribution to policymakers: This research informs policymakers and funding agencies on the critical role of team composition in USO success. By identifying key team structures and competencies at different growth phases, the findings can guide targeted interventions to enhance USO sustainability. This includes refining funding strategies and support mechanisms that foster effective team development in academic entrepreneurship.

2 Theoretical framework

2.1 The relevance of USOs - State of art

University spin-offs are companies that originate from the knowledge and technologies developed within a university environment. These spin-offs typically use technology-based ideas or research outcomes generated by a University (students/staff) (Rasmussen et al., 2011). While some define a USO as firms exploiting intellectual property or patented inventions resulting from university research (Hunady et al., 2019), others consider them as enterprises founded by individuals associated with a university, which could be either staff, graduates, or current students (Ortín-Ángel & Vendrell-Herrero, 2010). In this study, we see USOs as companies that are formed to commercially exploit research results, knowledge, or technologies developed within a university.

Even though, in the beginning, USOs are starting ventures, they differ from 'the normal start-up'. Start-ups are founded by entrepreneurs who can have various backgrounds and varying motivations like market opportunity, innovation, or entrepreneurial ambition. They aren't necessarily linked to academic institutions (Colombo & Piva, 2012). University spin-offs are linked to a University, and are generally founded by individuals with extensive research experience like researchers, PHD-students, professors, and others (Clarysse, 2000; Rasmussen et al., 2011). Furthermore, Spin-offs often must take more key stakeholders into account like the university and financial suppliers (like venture capitalists). This adds another layer of complexity to the development (Vohora et al., 2004).

2.1.1 USO development process

The development of USOs is a complex and dynamic process that requires balancing technical expertise, entrepreneurial competencies, and strategic decision-making. These ventures are often created to commercialize research outcomes and intellectual property generated within academic institutions (Rasmussen et al., 2011). However, translating research into a commercial sustainable business presents a significant challenge that USOs must overcome.

Several models attempt to explain the development trajectory of USOs, including the *'process-based technology commercialization model'* proposed by Shane (2004) or the *'USO growth pathways'* as proposed by Clarysse et al. (2005). However, this study adopts the Vohora et al. (2004) model, as it provides a structural framework for understanding the key challenges USOs face during their growth. This model outlines five distinct phases; research, opportunity framing, pre-organization, and sustainable returns. Each is separated by a critical juncture. These junctures represent significant barriers that spin-offs must overcome to progress to the next development phase. While the model provides a strong foundation for understanding the general development of USOs, it does not specify how teams can effectively navigate these challenges. This study aims to build upon the model by linking team composition to these growth phases and junctures, exploring how specific roles and skills influence the USOs' ability to progress successfully.

The five development phases

1. Research phase

The research phase focuses on generating new knowledge and intellectual property, typically within a university setting. In this stage, academic researchers are often driven by scientific curiosity and the desire to publish rather than by commercial ambitions. Vohora et al. (2004) emphasize that at this stage, commercialization is often not the primary focus, as research is conducted primarily for academic purposes rather than with market applications in mind.

However, in practice, this varies significantly depending on the institution, research field, and individual motivations. While some researchers follow the traditional path of academic discovery, others enter their PhD or postdoctoral research with an explicit commercial vision, aiming to develop marketable technologies from the outset. For example, in applied fields such as biotechnology, AI, or engineering, researchers may actively engage with industry partners early on, influencing how quickly they transition to the next phase.

This difference in mindset affects the speed and trajectory of USO development. Researchers who recognize commercial potential early may take steps to secure patents, explore industry collaborations, or seek funding opportunities while still in this phase. Those focused purely on research may only begin considering commercialization once they have already made significant technical progress, potentially delaying the transition to the next phase.

2. Opportunity framing phase

Once a research outcome has been found, the next challenge is to define its market potential and feasibility. The opportunity framing phase involves assessing whether the innovation has a clear commercial application, a viable customer base, and sufficient technological feasibility to be developed into a sustainable business.

A major challenge here is that academic entrepreneurs often lack the necessary market insight, business knowledge, and industry connections to effectively frame their opportunities. Many USOs struggle because their founders are deeply immersed in the technical aspects of their innovation but have limited exposure to commercialization. Without early customer validation, business mentorship, or industry input, the risk of pursuing an impractical or ill-defined business opportunity increases.

To address this, Universities' Technology Transfer Offices (TTOs) and investors are often introduced at this stage, offering support in exchange for equity in the spin-off. While such involvement can provide essential financial and strategic resources, it can also limit founders' autonomy, as external stakeholders may push for directions that differ from the academic entrepreneur's original vision. Finding the right balance between external support and founder control is critical in this phase, as it determines how effectively the USO can shape its long-term trajectory.

3. Pre-organization

The pre-organization phase is where the USO transitions from an idea into a structured business. At this stage, the founding team must develop a strategic plan, secure resources, and refine their business model. This is often the first real test of the USO's commercial potential, as investors, partners, and customers begin evaluating its viability.

A key challenge in this phase is credibility. Many USOs lack a commercial track record, making it difficult to convince investors or partners of their potential. Moreover, technical founders often prioritize product development over market validation, which can slow down commercialization. Some USOs attempt to build a strong advisory board to compensate for their lack of business experience, while others bring in external co-founders with industry expertise to strengthen their leadership team.

At this stage, funding is a critical concern. Some USOs secure early-stage investment from university funds, grants, or industry partnerships, while others rely on bootstrapping until they can demonstrate commercial viability. The ability to attract funding early can significantly influence how quickly a USO moves into the next phase.

4. Re-orientation

The re-orientation phase is an inflection point in USO development. At this stage, the USO has entered the market, but real-world conditions often force strategic adjustments. Early assumptions about market needs, customer demand, or competitive positioning may prove inaccurate, requiring founders to pivot or refine their approach.

This phase is where the difference between theoretical business planning and actual market experience becomes evident. Many founders recognize at this stage that their initial go-to-market strategy does not work as expected, forcing them to either refine their product, redefine their target market, or shift their business model entirely.

How well a USO adapts at this stage depends on its team's ability to recognize market feedback and act accordingly. Some ventures successfully reorient by bringing in experienced executives, seeking industry partnerships, or diversifying their revenue streams. Others, however, struggle to pivot effectively, leading to stagnation or failure.

5. Sustainable returns

The final phase represents the transition to an independent, sustainable business. By this stage, the USO has refined its business model, secured stable revenue, and built a leadership team capable of long-term management. However, sustainability does not mean the elimination of all risks.

Even after reaching this phase, USOs may still face market resistance, technological shifts, or competition from established firms. Some remain in niche markets with limited scalability, while others struggle with scaling operations efficiently. The ability to continuously innovate, attract top talent, and adapt to market changes often determines whether a USO thrives long-term or plateaus.

The critical junctures

As USOs progress toward commercialization, they must overcome four critical junctures that determine whether they can transition from research-based projects to sustainable businesses. These junctures represent key challenges where academic entrepreneurs must shift their mindset, make strategic decisions, and establish credibility in the market.

1. Opportunity recognition

The first juncture, opportunity recognition, involves identifying the commercial potential of a research outcome. While innovative discoveries frequently emerge in universities, recognizing their business potential requires a shift from a purely academic mindset to an entrepreneurial one. Many researchers remain focused on scientific progress, and without external guidance, promising innovations may never be commercialized. Technology Transfer Offices (TTOs) and investors often play a crucial role at this stage by identifying high-potential ideas and helping researchers understand their market applicability.

2. Entrepreneurial commitment

The second juncture, entrepreneurial commitment, requires researchers to decide whether to dedicate themselves fully to their spin-off. While theory suggests that founders should transition completely from academia to entrepreneurship, this is not always the practice case. Some founders view their USO as an extension of their research and attempt to balance both roles, while others struggle to leave the security of an academic career. This juncture is particularly challenging because research is often conducted in teams, and not all collaborators may be willing to make the entrepreneurial leap. When this happens, the individual moving forward must be prepared to take on the risks and responsibilities of commercialization, sometimes without their original research team.

3. Threshold of credibility

The third juncture, venture credibility, determines whether the USO can gain trust from external stakeholders such as investors, customers, and industry partners. While academic expertise provides technical credibility, it is not enough to attract funding and establish a strong market presence. Founders must demonstrate a clear business case, a well-defined market fit, and a capable leadership team. At this stage, team composition plays a crucial role—bringing in individuals with commercial expertise can significantly improve the USOs' ability to secure funding and strategic partnerships.

4. Threshold of sustainability

The final juncture, venture sustainability, represents the transition from an early-stage business to a long-term, scalable company. Even after establishing a stable operation, USOs face ongoing challenges such as scaling production, staying competitive, and maintaining financial independence. Those with a strong product, a solid market position, and an experienced team are more likely to overcome these challenges. However, sustainability depends not only on external factors such as market demand



but also on internal decision-making, continuous innovation, and the ability to adapt to changing business environments.

While these junctures serve as structured transition points, in practice, USOs often experience nonlinear progress, encountering setbacks that require them to revisit earlier stages. Successfully overcoming these challenges depends on a combination of entrepreneurial mindset, team composition, and external support—factors that influence the long-term success of spin-offs.

Validity and relevance of the Vohora model

Since its introduction, the model Vohora et al. (2004) has remained a widely used framework for understanding the challenges USOs face. Several studies have applied and validated its relevance in different contexts throughout the years (Hayter, 2016; Lazar et al., 2020; Radko et al., 2023; Zahra et al., 2014). However, recent studies also proposed alternative models that emphasize different aspects of USO growth.

While Vohora et al. (2004) is a relatively older framework, it remains one of the most comprehensive models for understanding USO development. More recent literature offers alternative perspectives on startup growth. For example, Hesse and Sternberg (2017) identify different growth patterns for USOs. In broader, startup literature Marmer et al. (2011) introduces a startup lifecycle model with stages such as discovery, validation, efficiency, and scaling, focusing on how startups transition from idea generation to a scalable business. Blank and Dorf (2020), on the other hand, advocate for the 'lean start-up' methodology, which prioritizes iterative learning, continuous customer feedback, and pivoting to refine business models and achieve sustainable growth. These models provide valuable insights into how startups evolve, but they focus more on market-driven growth rather than the unique transition from academia to business that USOs undergo.

Vohora's model remains the most suitable framework because it specifically accounts for the academic-to-commercial transition, detailing the key phases USOs go through, and the structural changes required for growth. Crucially, this model allows for a direct link between team composition and each phase of development, making it particularly relevant for this study. While newer models contribute valuable insights into startup growth more broadly, there has been little to no development of a dedicated USO growth model in recent academic literature. Given this gap, Vohora et al. (2004) still provides the most complete, process-oriented perspective on how USOs develop, making it the best choice for this research.

2.2 The impact of USO team composition

The literature identifies team composition as a critical success factor in the performance of USOs, particularly due to the unique environment in which these ventures operate (Mustar et al., 2008). Unlike typical high-tech startups, USOs focus on translating scientific innovations into commercial products, resulting in founding teams that consist primarily of research-focused academics. While these individuals are highly skilled in technical development, they often lack the managerial and commercial expertise needed to scale the business and manage key stakeholders. USOs must engage with multiple stakeholders like universities, public authorities, investors, and industry partners, each with different expectations. Effective stakeholder management requires a well-balanced team that combines scientific knowledge with entrepreneurial and communicative skills (Visintin & Pittino, 2014). Furthermore, USOs often carry an implicit responsibility to contribute to societal and economic

development due to their academic origins and stakeholders. Universities and public authorities expect them not only to generate financial returns but also to drive innovation, regional growth, and knowledge transfer. However, these expectations can sometimes be unrealistic, (Mustar et al., 2008). Due to this pressure, USO teams may need strong managerial skills and strategic expertise to balance commercial objectives with societal expectations. Strong leadership and entrepreneurial capabilities can help align the USO's mission with external demands.

USOs also tend to have more homogenous teams, compared to independent startups (ISU), mainly due to their institutional environment, educational backgrounds, and limited industry experience (Ensley & Hmieleski, 2005; Knockaert et al., 2011). Founders of USOs often recruit team members with whom they share a prior relationship, leading to teams with similar skill sets and perspectives. While homogeneity may reduce conflict, it can limit constructive debate and critical thinking, which are essential for effective decision-making and innovative problem-solving (De Dreu & West, 2001).

According to Katz's (1982) classification of skills into technical, human, and conceptual categories, USO teams typically possess high levels of technical expertise but often lack human and conceptual skills, such as interpersonal skills and strategic thinking.

Additionally, the size of the USO team plays an important role in its effectiveness. Smaller, cohesive teams are generally more agile, facilitating quick communication and decision-making, which is crucial in the early stages when rapid adaption is needed. However, as the USO grows, a larger, more diverse team becomes essential to handle the increased complexity of tasks like product development, market entry, and scaling. (Visintin & Pittino, 2014)

Another important aspect of the USO team composition according to Juan Pablo et al. (2016) is age and experience. A mix of younger and older team members can be beneficial due to the mix between young members who bring fresh ideas and technological skills, and older members who provide experience and strategic insights.

2.2.1 The impact of USO team composition on acquiring funding & resourses

Team composition plays a significant role in USOs' ability to attract financial resources. According to venture capital literature, the quality of the USO team is one of the most critical factors in investors' decision-making processes (Clarysse & Moray, 2004; Cyr et al., 2000). In addition to team quality, investors look for specific attributes within the team that signal capability and adaptability in challenging markets.

A diverse team composition, which includes a balance of technical and commercial expertise, enhances a USO's credibility and appeals to investors by demonstrating the venture's capacity to address both scientific and market demands (Moog & Soost, 2022). Besides diversity in skills, team size also plays a role in investors' decision-making

Clarysse and Moray (2004) highlight that the size of the entrepreneurial team can impact funding success. While larger teams may appear more attractive to investors due to the diversity of skills they can offer, they also pose management challenges that need to be carefully balanced. However, it's not just team size and diversity that matters; specific entrepreneurial competencies can also impact a team's ability to attract funding.

High social capital within a USO team can significantly increase the chances of attracting external funding. Shane and Stuart (2002) Found that when team members

have strong networks and industry connections, investors are more likely to view the venture as credible and low-risk. These connections provide access to valuable resources and insights, making the USO more attractive to potential investors. Essentially, a well-connected team not only enhances the USOs' market reach but also builds trust with investors, which is especially important in the early stages of growth. Finally, a team's learning orientation and adaptability further contribute to investor appeal.

Having a strong learning orientation and showing adaptability within the USO team is proven to positively influence the ability to attract funding. Zahra et al. (2006) found that investors value teams that demonstrate flexibility and willingness to learn, as these traits are crucial for navigating uncertain markets. For USOs, this adaptability signals resilience and openness to continuous improvement, both of which are highly appealing to investors.

2.2.2 The impact of USO team composition on entrepreneurial competence and development

Since USOs are very much like normal companies, it is essential to have entrepreneurial competencies within the company. These competencies need to be either in the company from the start or must be required later to make sure the venture thrives.

Entrepreneurial competence often develops progressively, with teams as they often initially rely on technical competencies like inventing to create and refine their product. When the company moves towards commercialization, founding competence, focused on commercialization and scaling—, is proven to become more essential, meaning entrepreneurial competence builds over time, evolving from technical and creative abilities toward business and market-oriented skills (Boone et al., 2020) ultimately ending up in a balance between the two competences.

Rasmussen et al. (2011) found in their study that three main key entrepreneurial competencies are necessary for the successful development of USOs. These competencies are opportunity refinement – which involves identifying and shaping business opportunities from research outcomes, leveraging, which means strategically using limited resources like funding and human capital, and championing; the ability to advocate for the venture, secure necessary resources, and build partnerships to drive commercialization. This aligns with findings from Hunady et al. (2019) that underscore that founding teams with enhanced capabilities positively affect the performance of spin-offs during their early growth phase (Huynh et al., 2017).

According to Clarysse et al. (2011) championing competency, often missing in USOs, is essential for their success and growth. This competency not only requires leadership and commitment but also the ability to secure resources, build partnerships, and enhance the spin-off's credibility. Given the research-focused nature of USO teams, they frequently lack these business-oriented skills. As a result, USOs often depend on external champions, such as experienced entrepreneurs or managers, who provide the business expertise and networks necessary to steer the venture toward commercialization. These external champions typically serve as advisors, as USO founders are usually hesitant to hand over control of their company to a new CEO. Hiring a new CEO often proves challenging because they must possess both technical expertise to understand the developed technology and strong business skills to lead the company. Since this combination is rare, bringing in a new CEO is often not the best option for USOs.

Developing these entrepreneurial competencies within USO teams can occur in two main ways: internally or through external recruitment. While USOs often rely on external advisors or entrepreneurs to fill these gaps, developing these entrepreneurial skills within the founding team can provide long-term benefits. Wright (2007) suggests that university incubation programs and mentorship opportunities can help build these competencies in academic founders, allowing them to balance technical and business demands more effectively.

Furthermore, team composition can also play a vital role in the development of entrepreneurial competencies. Knockaert et al. (2011) argue that heterogenous teams, composed of members from both technical and business backgrounds, are better equipped to develop a range of entrepreneurial skills. As USOs grow, fostering a diverse team becomes critical in driving the necessary competence for scaling and commercialization (Vohora et al., 2004) and makes sure that these teams are equipped to fulfil the complex startup demands by leveraging a wider range of perspectives (Moog & Soost, 2022)

2.2.3 The impact of USO team composition on scaling strategies

Generally, USOs face significant challenges when it comes to scaling. Unlike traditional startups, USOs are often constrained by limited resources, a narrow market focus, and a strong research orientation which can hinder their ability to grow beyond the initial stages (Mathisen & Rasmussen, 2019; Vohora et al., 2004). USOs often excel in early development but struggle to transition from a technology-driven focus towards more market-oriented, scalable enterprises (Siegel & Wright, 2015). Therefore, research has been conducted to identify the most effective scaling strategies, tailored to the unique environment of USOs.

For the scaling of USOs, different strategies have been found in literature. For example, Mathisen and Rasmussen (2019) found that USOs generally have two options when it comes to scaling; incremental or rapid scaling. According to this study, USOs benefit from incremental growth in the early stages due to the complex, research-intensive nature of their innovations. However, as they mature, they often adopt a more rapid scaling strategy becomes essential to capitalize on first-mover advantages and market opportunities. Siegel and Wright (2015) Emphasize the impact of having a market-oriented focus on USO scaling. USOs need to adopt a market-oriented focus, which includes understanding customer needs and ensuring that products align with market dynamics. This shift requires a transition from technical development to strategic marketing and sales orientation.

Scaling effectively requires a team with strong entrepreneurial skills, particularly in leadership and decision-making, which are often lacking in academic environments (Huynh et al., 2017). Furthermore, as USOs scale, teams must develop capabilities in financial management, strategic scaling, leadership, and market entry (Clarysse et al., 2011). Diverse teams with both technical and commercial expertise are better equipped to handle these challenges, and studies show that bringing in external talent or fostering internal leadership competencies can greatly improve a USO's ability to scale (Knockaert et al., 2011).



2.2.4 Evolving team composition through development phases

The development of university spin-offs (USOs) is a multi-phase process, where ventures transition from research-driven initiatives to fully established businesses. As outlined by Vohora et al. (2004), each stage presents distinct challenges, requiring USOs to overcome critical junctures such as opportunity recognition, entrepreneurial commitment, credibility, and sustainability. Successfully navigating these transitions is not only a matter of technological innovation but also of having the right team composition to address evolving needs.

Taking both USO development phases and the need for a suiting team composition in mind, it becomes clear that team composition evolves alongside USO development. In the earliest stages, USOs are small and research-focused, emphasizing technical expertise and innovation (Vohora et al., 2004). As they move beyond research, the opportunity recognition juncture requires entrepreneurial skills to identify market potential and secure funding. Literature suggests that teams with entrepreneurial experience and a market orientation are better suited to this transition (Knockaert et al., 2011; Rasmussen et al., 2011).

As commercialization approaches, credibility becomes critical, as investors and partners seek reassurance of the venture's viability (Vohora et al., 2004). Research indicates that teams with a balance of technical and business expertise, along with strong social capital, are more likely to attract funding and partnerships (Shane & Stuart, 2002; Visintin & Pittino, 2014).

In later stages, the sustainability juncture requires a shift from a founder-driven structure to a more formal organization (Vohora et al., 2004). Literature suggests that while small, agile teams work early on, scaling often requires experienced executives and operational specialists to manage complexity (Clarysse et al., 2011; Mathisen & Rasmussen, 2019).

Thus, the literature indicates that team structures may need to evolve throughout USO development, but how this occurs in practice remains underexplored. This study aims to bridge this gap by examining how teams adapt to different growth stages.

3 Methodology

3.1 Research strategy

This study employs a qualitative approach, which is most suitable for exploring team development in depth. A qualitative research methodology allows for a nuanced understanding of complex phenomena in different contexts, making it the best option for investigating how and why USO teams evolve (Choy, 2014). Since each company, and each team has its unique development trajectory, underlying motivations, and challenges, a qualitative approach enables a possibility to explore these factors more than a purely quantitative analysis would allow.

To gain a deep insight into the evolution of USO teams, semi-structured interviews were conducted with USO founders or key people involved in the spin-off process. This method was chosen because it provides flexibility in exploring relevant themes while maintaining a structured framework to ensure comparability across the different cases (Bryman, 2016). By allowing interviewees to share their experiences in their own words, this approach facilitated a richer understanding of not only how their teams were developed but also which decisions were made, and what drove these decisions. Given that every USO has its development trajectory, capturing the full narrative of each interviewee was essential to uncovering the different possible development stories.

Since this research method mainly relies on interpretations; some potential biases can be introduced. The findings are based on the subjective views of the interviewees, meaning that they are inherently influenced by personal experiences and their perspectives. Additionally, there is also a risk that personal preconceptions of the researcher may shape the way the responses are understood and interpreted (Bryman, 2016). To mitigate this risk, a structured, yet flexible interview guide was used to ensure consistency across the different interviews (Appendix A). Even though this method comes with some potential limitations and biases, it remains the best option to assess the USO team development for the different companies.

3.2 Case selection

To investigate the development of USO teams, this study focused on established spinoffs in the Netherlands that met specific selection criteria. The USOs had to originate from a Dutch university, with their founding ideas stemming from research conducted within the university. Additionally, only companies with a team of more than three people were considered, as this ensured that the spin-off had experienced enough growth and different team dynamics, allowing for meaningful insights into team formation and development. Furthermore, to avoid a too narrow sectoral focus and to ensure there is some variance in the sample, USOs were selected from diverse industries, ranging from biotechnology to infrastructure to movement science.

A purposive sampling approach was used, as the selection process was guided by specific inclusion criteria rather than random sampling. To identify suitable participants, I reached out to a large number of USOs through various channels, including email, website contact forms, phone calls, and LinkedIn messages.

The final sample consisted of ten USOs, a number chosen based on both feasibility and reliability. Given the large number of USOs in the Netherlands (only the University of Twente already has more than 1200 spin-offs by itself), covering a comprehensive sample of the entire population was impractical within the scope of this thesis. Instead, the selected cases allowed for rich, high-quality data collection, with each interview providing valuable insights into team development. Since this research is qualitative, the focus was on depth over breadth, ensuring that insights were explored in detail rather than being diluted by an excessive number of interviews. A larger sample within the given time frame would have limited the ability to deeply analyse individual cases, potentially compromising the depth of understanding. By prioritizing fewer, more detailed interviews, this study ensures a stronger grasp of team dynamics and evolution within USOs. This ensured that the sample was not only manageable but also sufficiently diverse and robust for an in-depth exploration of the research question. An overview of the sample is shown in Table 1: *Sample of USOs*

Spin off code	Sector	Founding year	Current growth phase	Current venture champion
SO1	Infrastructure	2012	Re-orientation	Surrogate entrepreneur
SO2	Biotechnology	2016	Re-orientation	Academic entrepreneur
SO3	Photonics	2023	Re-orientation	Surrogate entrepreneur
SO4	Biotechnology	2018	Re-orientation	Academic entrepreneur
SO5	Medical technology	2015	Re-orientation	Academic entrepreneur
SO6	Advanced materials	2015	Pre-organization	Surrogate entrepreneur
SO7	Health tech	2022	Re-orientation / sustainable returns	Academic entrepreneur
SO8	Health tech	2020	Re-orientation	Surrogate entrepreneur
SO9	Wearable technology	2023	Pre-organization / re-orientation	Academic entrepreneur
SO10	Noise reduction	2023	Pre-organization	Academic entrepreneur

Table 1: Sample of USOs

3.3 Data collection

The primary data for this study was collected through semi-structured interviews with USO founders or key team members, the interviews were conducted either online via Microsoft Teams or in person at the company's location, depending on the proximity and preference of the interviewee. Each interview lasted between 45 and 60 minutes, with a few exceptions where discussions extended slightly longer.

The interviews followed a structured guide, with questions primarily focused on the different development stages of the company. However, the flexible nature of the semistructured interviews allowed for in-depth exploration of specific topics that emerged during the conversations. While the interview guide ensured a consistent framework across cases, each interview took its direction based on the interviewee's experiences and insights. The interview questions covered several key themes, including the background of the spin-off and its founders, the identification of development stages according to the Vohora et al. (2004) model, challenges encountered during growth, and the evolving role of team composition throughout these stages. A complete version of the interview guide, including all questions and themes, can be found in Appendix A.

To ensure that participants fully understood the research topic, they were provided with an overview of the research model before the interview. Additionally, the purpose of the study was explained, clarifying what insights were being sought. Before beginning, explicit consent was requested to record the session.

For online interviews, the recording and transcription were handled through Microsoft Teams, while in-person interviews were recorded using a recording application, later uploaded to the computer, and transcribed using Amberscript. After transcription, all data was fully anonymized to protect participants' identities and ensure confidentiality. The anonymized transcripts were then securely stored on OneDrive, protected by a personal lock to prevent unauthorized access.

In addition to the primary data, secondary data was collected by analysing the LinkedIn profiles, company websites, and scientific backgrounds of spin-off employees, using sources such as Google Scholar and Scopus. This data was used to identify patterns that helped validate the findings.

3.4 Data Analysis

The transcripts were analysed using the Gioa method (Gioia et al., 2013), a structured approach to qualitative data analysis that ensures transparency while allowing themes to emerge from the data. This method is suitable for this study because it provides a systematic way to organize qualitative insights, bridging rich, descriptive perspectives with theoretical concepts. By structuring the analysis in multiple stages, the Gioia method helps capture both the unique narratives of individual USOs and the broader patterns in team development.

To analyse the interview data, I followed a structured approach to generate first-order codes, second-order themes, and aggregate dimensions. The process began with a detailed review of the interview transcripts, where I highlighted key statements and meaningful insights expressed by participants. This initial phase of open coding allowed me to capture relevant observations without predefining categories, ensuring that the data guided the coding rather than being forced into existing theoretical constructs.

After marking all the significant statements, I compiled around 600 initial statements that contained relevant insights. Since the interviews followed a semi-structured format based on an interview guide, many participants addressed similar topics, although, many times with different words. To refine the codes, I systematically compared responses, identifying similarities and variations across participants. If multiple interviewees described the same phenomenon in different words, I combined these statements under a single representative code while ensuring that subtle differences were persevered where necessary. In case of near-identical repetition, redundant statements were removed to avoid overrepresentation, leaving me with approximately 40 first-order codes.

Next, I grouped the first-order codes into second-order themes. This process involved both identifying similarities among codes and analysing them with existing literature on USO development. Specifically, I examined how the emerging themes aligned with established concepts such as dynamic capabilities (Teece et al., 1997), which are essential for navigating growth and championing competence (Rasmussen et al., 2011), which USO founders frequently highlighted as key entrepreneurial skills. Additionally, the importance of a well-balanced team (Heirman & Clarysse, 2007) emerged as a recurring theme in both the data and existing research. By integrating these theoretical perspectives, I ensured that the coding process remained both empirically grounded (with data) and theoretically informed (by linking it to literature)

Finally, I combined the related second-order themes into aggregate dimensions that captured broader patterns within the data. At this stage, I focused on identifying overarching concepts that encapsulated multiple themes under one overarching dimension.

To enhance the reliability of the findings, the transcripts were reviewed multiple times to check for any missing important statements or codes. Additionally, some of the second-order themes were linked to existing literature providing a theoretical foundation for the findings. To further strengthen the validity of the analysis, the codes were also cross-checked by an experienced researcher in the field of USO research, ensuring that the interpretation of the data was accurate (Miles et al., 2014).

The secondary data was used to assess the academic or commercial backgrounds of individuals involved in each USO. The H-index, retrieved from Scopus profiles, was used as an indicator of research strength. Team composition, role descriptions, and hiring patterns were also examined to identify whether ventures developed more scientifically oriented or practically focused teams. Through this analysis, patterns were identified linking the background of the leadership team to the strategic orientation and team development within each spin-off. A short overview of these findings can be found in Appendix B: *Analysis H-index of USO teams*.

4 Results

The purpose of this study is to explore how team composition influences the successful development of university spin-offs (USOs) as they progress through different growth stages. Specifically, this research aims to identify how the balance between technical expertise and commercial or business-oriented skills evolves, as both are critical for successfully navigating the transition from research to commercialization. This study is guided by the following research question: *"How does the optimal team composition evolve as University Spin-Offs (USOs) progress from their founding toward the sustainable returns phase?"*

By employing a qualitative research design and conducting a series of ten semistructured interviews with USO founders and key team members, this study captures insights into how these teams evolved, what challenges they encountered at each development stage, and how team composition and dynamics adapted to meet these challenges.

The main findings are presented in the data structure below (see Figure 1), which follows the Gioia method for qualitative data analysis. The data is structured into first-order concepts (direct quotes and observations), second-order themes (broader patterns identified across cases), and aggregate dimensions (overarching findings that capture the core insights of this research). This structured approach ensures transparency in how raw data is interpreted and transformed into meaningful results.



UNIVERSITY OF TWENTE.



Figure 1: Gioia structure

4.1 Technical nature of USO

The first finding is that USOs generally originate from research-driven environments, resulting in a strong technical focus in the early stages of the new venture. As shown in Figure 1, this aggregate dimension emerged from two second-order themes; 'USOs being driven by academic objectives, with commercialization as a byproduct' and 'the early technical focus and its limitations.' These themes demonstrate that most USOs originate from academic objectives rather than market demand, leading to a strong technical focus that presents both advantages (technological depth) and challenges (market readiness, investor scepticism). This shapes their early development trajectory and influences business decisions.

4.1.1 Academic-driven origins and market gap

USOs emerge from university research projects that demonstrate high technological potential, but most research projects are not necessarily started with marked needs in mind. As highlighted in the first-order concept, research is primarily conducted to fulfil academic requirements, such as PhD research. Since these projects prioritize scientific novelty over commercial viability, many USOs face early challenges in identifying clear market applications and attracting initial customers. This pattern was

evident in all the ten interviews. Where some founders had a commercial interest, there was no research conducted that was based on market demand.

This finding aligns with prior literature on USO development Clarysse et al. (2011) which suggests that many spin-offs emerge from a technology push, rather than a market pull. While the technology might be highly innovative, it may lack clear market applications and early customers, increasing the early development risks. This approach puts USOs at a distinct disadvantage compared to market-driven startups.

This finding highlights the importance of introducing business-oriented competencies into the team at an early stage, either through co-founders with business expertise, early-stage advisors, or entrepreneurial training for academic founders. Without such early business involvement, USOs risk misaligning their technological development with market needs, which can significantly slow their transition through Vohora's (2004) opportunity framing and credibility threshold phases.

4.1.2 The role of academic founders

Another important reason why USOs tend to have a technical-heavy start is the composition of their founding teams. In most cases, these teams were predominantly academic, with founders drawn directly from university research projects. As a result, many teams lacked entrepreneurial experience and business expertise, which led to an early focus on technology development over commercial strategy. This technology-first mindset delayed early market validation, increasing the risk of product-market misalignment. As one founder reflected: *"Looking back, I'd focus on launching a true MVP, just the core functionality rather than overdeveloping early on."*

This technical focus also made it more difficult for USOs to build credibility with investors, who often prefer teams that combine technical and business skills (KAPLAN & STRÖMBERG, 2004). Several founders noted that the absence of commercial expertise within the team led to missed funding opportunities. In a few cases, however, early involvement of external investors or advisors helped bring in commercial expertise, highlighting that external input can partially compensate for gaps in founding teams.

These findings show that founding team composition significantly shapes early development choices and directly affects USOs' ability to cross Vohora's (2004) credibility threshold, underlining the importance of addressing commercial skill gaps at an early stage.

4.1.3 Implication on team composition and its evolution

A technical-heavy nature offers both strengths and weaknesses for USO development. While deep technological expertise can cause competitive advantages, it often comes with a slower transition to market entry due to a lack of commercial focus. To take advantage of its strengths, and minimize its weaknesses, founders should diversify their team by integrating business-oriented member(s) early on to keep a balance between technical development and market entry whether by co-founding with a business-orientated partner, hiring a commercial expert, or engaging experienced mentors. However, forcing a professional CEO into the team too early should be avoided as this often fails (Clarysse & Moray, 2004)

Over time, as the USO progresses through the stages of development, the team must evolve. What generally begins as a technical-heavy, academic group must gradually transform into a more balanced team with distinct business and leadership capabilities. This evolution is crucial for crossing Vohora's (2004) credibility and sustainability thresholds, where professionalization, clearer role separation, and commercial expertise become more important. Thus, while the initial technical focus is proven to be very important in the start, later in the development it must give way to a more hybrid team structure that aligns with the scaling need of the venture.

4.2 Parent universities' TTO and external support in USO development

The second aggregate from Figure 1 is in the context of early USO support in the shape of either a TTO or external support. This aggregate dimension is built up out of two second-order themes; 'University influence and early-stage support' and 'leveraging external expertise and early strategic hires for growth'. Early guidance from universities' TTOs and external experts significantly influences USO growth, bridging the gap between technical and business expertise. While this support accelerates commercialization, USOs often struggle to attract experienced professionals due to financial constraints and perceived risks.

4.2.1 Universities' TTO as early support

TTOs and incubator programs played a crucial role in the early development of 7 out of 10 cases. The TTOs supported the USOs by providing mentorship, training, and business development support. This support was especially important for academic-heavy teams as it exposed into entrepreneurial processes, they were unfamiliar with such as building a business model and structuring deals.

"The incubator program taught us how to reach out, send emails, make calls, attend fairs, and invite potential partners to our lab. Experienced entrepreneurs shared their insights, having built their startups. We also took courses on building a business model, structuring deals, and setting the right product pricing."

4.2.2 The impact of external expertise on USO growth

A second important finding is that the early involvement of experienced professionals, such as former entrepreneurs, investors, or market analysts, contributed to faster growth trajectories for several USOs. These external experts brought practical knowledge in areas like scaling, securing funding, and navigating market entry, helping to compensate for the academic founders' lack of commercial expertise. As one founder stated: *"Our development moves faster than if a typical PhD were starting alone, due to our experienced management team."*

However, attracting such experienced individuals at an early stage proved challenging for most USOs, primarily due to the high risk associated with academic spin-offs and the limited financial resources available in the initial phases. As one founder explained: *"But it's quite hard to find such a person, especially the experienced person in the business."* This reflects that while external expertise can accelerate development, access to this expertise remains uneven, leaving some USOs to rely solely on their internal academic team for much longer. This further reinforces the importance of early



team diversification and highlights that the ability to attract external expertise is itself a factor influencing USO development speed.

4.2.3 Implications on team composition and its evolution

The findings suggest that TTO's and incubator programs can provide critical earlystage guidance and long-term growth, success depends on integrating expertise in the team this can be either external (consulting role) or by adopting expertise within the team. These findings show the importance of a strategic team composition for USO success. While technical expertise is essential, adopting business knowledge is also proven to be crucial to have the ability to grow further than a technical concept.

This highlights an important evolutionary trajectory: USOs often begin by relying on external resources to compensate for internal capability gaps. Such support plays a crucial role in helping ventures overcome early-stage challenges, including achieving entrepreneurial commitment and being perceived as credible in the eyes of stakeholders. However, as USOs grow, they begin to develop and acquire these capabilities internally, reducing their dependence on external actors. In this sense, university-based or external support is most valuable during the transitional phase from research to commercialization. To ensure long-term sustainability, the team must gradually internalize business expertise and strive toward building a self-sufficient, commercially competent organization.

4.3 The role of entrepreneurial competences and personal transition in building market-ready ventures

As a research outcome, becomes the start of a commercial venture, their founders must undergo a fundamental shift as well. They must change from a technical specialist to an entrepreneurial leader. This transition is not just about learning to read a balance sheet, but also about developing an entrepreneurial mindset, taking ownership, and building the right team structure to support commercialization. This aggregate dimension consists of two second-order themes: 'Championing competence' and 'cognitive transition from specialist to entrepreneur' both of which highlight the critical role of mindset, adaptability, and leadership in successfully developing a market-ready venture.

4.3.1 Championing competence

A key factor influencing USO development is the presence of championing competence, meaning the founder's ability to take ownership, secure resources, and actively drive commercialization. As most founders in this study came from academic backgrounds, this entrepreneurial competence was not standardly present and had to be actively developed or attracted over time. However, a recurring pattern across the interviews showed that, despite their academic roots, some founders demonstrated a strong personal motivation to start their businesses. This intrinsic commitment helped them push through early commercialization hurdles, even though they lacked formal entrepreneurial training. This suggests that while technical expertise dominates early team composition, personal commitment and willingness to acquire entrepreneurial skills can partially compensate for initial business competence gaps, at least during the early stages of USO development.

4.3.2 Cognitive shift from specialist to entrepreneur

Developing a successful USO requires founders to transition from specialist to entrepreneur, moving beyond deep technical expertise to gain foundational business skills. Most founders admitted they initially lacked this knowledge but showed a strong willingness to learn, actively seeking courses, mentorship, and practical experiences to build their business understanding. One founder explained: *"I took every opportunity I could to learn more about entrepreneurship, business development, IP, patents, and more."*

This learning mindset helped many founders retain leadership control, avoiding the need to hand over the company to a commercially experienced one. At the same time, many successful founders also recognized the key trait of being humble meaning; they knew their limitations, and knowing when to delegate specialized tasks rather than trying to master everything themselves. This combination of continuous learning and strategic delegation emerged as a recurring pattern, showing that for USOs, having a leader or CEO who combines both business acumen and a solid understanding of the underlying technology is particularly beneficial. This balanced leadership profile allows the CEO to effectively bridge the gap between technical development and commercial strategy, which is crucial for high-tech ventures like USOs.

4.3.3 Implications on team composition and its evolution

To successfully lead a USO, founders must develop business and leadership skills alongside their technical expertise. Rather than relying fully on external managers, many take an active role in commercialization while continuing to drive innovation. In the early stages teams are typically lean and technical, with founders covering multiple roles.

To support the transition from researcher to business leader, founders can bring in mentors or advisors to bridge business knowledge gaps and guide early decision-making. As the USO progresses toward the *credibility* and *sustainability* thresholds, delegation becomes essential. Founders begin assigning specialized tasks in areas like finance, R&D, operations, and sales, shifting into a more rounded leadership role that combines scientific credibility with entrepreneurial competence.

This marks a broader evolution from a founder-centric team to a strategically structured leadership group, capable of managing both innovation and commercial growth.

4.4 Dynamic team composition

USOs develop from their start through different growth stages, with each stage having its characteristics and challenges. This means that the environment constantly is changing. Therefore, USOS must be equipped to handle these changes. This can be done by building a dynamic team composition. A dynamic team can meet the demands and adapt to a changing environment. The findings highlight three key aspects of dynamic team compositions: 'The importance of a balanced team', 'dynamic capabilities that enable growth', and 'increasing role specialization as the USO scales'

4.4.1 The importance of a balanced team

A recurring theme in the data is that while technical expertise is crucial, it must be complemented by business acumen to ensure both market success and smooth development. This need for balance was highlighted by most interviewees, who experienced first-hand how imbalanced teams, especially in the early stages, led to slower market entry and difficulties in attracting investors.

The data shows that this balance shifts throughout the development process. In the earliest stages, ventures tend to be technology-heavy, as research and product development take priority. However, during the market entry stage, the need for business skills, such as market validation, pricing, and sales, becomes more urgent. Several founders emphasized that when companies needed to pivot or refine their offering, successful adjustments required close collaboration between technical and business expertise to find the best product-market fit.

This confirms that a balanced team is not a static requirement but a dynamic one, meaning the optimal combination of skills changes as the USO progresses through its development stages. Teams that actively adjusted their internal skill mix were better able to respond to external feedback and navigate critical junctures like opportunity framing and credibility building. This underscores the importance of viewing team composition as an evolving process, rather than a fixed snapshot at the founding moment.

4.4.2 Dynamic capabilities for growth

A balanced team is essential for USO growth, as both technical and business capabilities must expand in parallel. This was emphasized by many interviewees, who described how scaling requires expanding the technical team to support production growth and product development, while simultaneously adding sales and marketing professionals to enable market entry, customer acquisition, and revenue generation. As one founder noted: *"Technicians and scientists are great at inventing and developing new ideas, but they are often less skilled at commercializing them successfully."*

This balancing act between technology development and market expansion highlights the importance of dynamic capabilities as the ability to continuously adjust team composition to fit the company's evolving needs. Founders also stressed that roles such as business development, supply chain management, and procurement become increasingly important as the company matures. Neglecting these roles or starting too late with implementing these roles can slow down growth or create operational bottlenecks.

These findings confirm that successful growth requires a flexible team-building approach, where technical and commercial competencies evolve together.

4.4.3 Increasing role specialization as the USO grows

In the early stages, USO founders often combine multiple roles, taking on responsibilities such as CEO, CTO, and CFO due to limited resources. In this phase, such role overlap is manageable because the company's operations remain relatively small, and the need for formal structures is limited. This generalist approach allows for flexibility, which is valuable in an uncertain early-stage environment.

However, as the USO grows, the need for specialized expertise becomes increasingly clear. Several founders described how they initially managed multiple tasks themselves, but as the business scaled, hiring dedicated employees for these roles

became essential to handle all the responsibilities. Similar shifts were mentioned regarding legal expertise, marketing, and Human resource management.

This progressive specialization was reported as a recurring pattern across many cases, showing the shift from start-up flexibility to organizational structure. Interviewees emphasized that early hires needed to be comfortable with broad, flexible roles, while later hires could afford to be more specialized with clearly defined functions. This confirms that the optimal team composition evolves from flexibility in the early phases to structured specialization in the later stages, meaning that managing this transition effectively is key for sustaining growth and professionalizing the USO.

4.4.4 Implications on team composition and its evolution

In the early stages, USOs must continuously adjust the balance between technical and business expertise. Teams often begin as tech-heavy to focus on product development and research. However, as ventures move toward market entry, business-oriented skills such as sales, business development, and marketing become increasingly critical. Founders should therefore prioritize building adaptable, balanced teams that can fullful the company's needs according to its current developmental stage.

This adaptability reflects the dynamic evolution of team composition. In the early stages, generalist roles and multitasking allow USOs to stay lean and flexible. However, as the venture approaches the later stages, a more deliberate shift is needed, from broad, overlapping responsibilities to specialized roles in operations, finance, legal, and market-oriented functions. Managing this transition is essential for scaling and professionalizing the organization.

Moreover, for sustainable growth, technical and commercial capabilities must both scale. Expanding R&D without corresponding investments in sales or customer development leads to resource inefficiencies, while aggressive market expansion without a robust technical foundation weakens product integrity, emphasizing the need for a dynamic balance.

Ultimately, the optimal team composition is not a fixed formula but a dynamic balance that evolves with the venture. The shift from early-stage flexibility to structured specialization can be seen as a requirement for the long-term success of USOs.

4.5 Strategic USO development choices

As USOs grow, they must make critical strategic decisions that shape their long-term development. While early hiring strategies focus on balancing workforce quality and cost-efficiency, another major shift occurs when investors begin influencing company leadership and decision-making. This aggregate dimension is built up out of two second-order themes: 'balancing workforce quality and cost-efficient hiring during growth' and 'investors' influence on leadership and strategic decision making'.

4.5.1 Balancing Workforce quality and cost-efficient hiring

USOs often face significant resource constraints in their early stages, requiring them to make strategic hiring decisions that balance workforce quality and cost-

effectiveness. One USO, which operated without direct investor pressure, strongly emphasized the importance of hiring based on actual need and quality, rather than expanding the team prematurely to meet externally imposed milestones. This founder stressed: *"It's always easier not to hire than to hire the wrong people, particularly for a startup because you're spending a lot of money to hire these people."* And *"you don't need 25 people to do a job that one person can do by himself. You need to hire the right person that can do the job of 10 people."* This underscores that for some USOs, lean hiring strategies—focusing on hiring only when essential and prioritizing versatile, high-quality hires—can help preserve both financial and organizational flexibility in the early phases.

In addition to careful hiring, three USOs highlighted the strategic use of students and interns as a cost-effective way to access talent. By involving students through internships or university projects, these companies were able to advance R&D while keeping personnel costs low. This strategy was seen as particularly useful for early-stage technical work, where students could contribute meaningfully under the supervision of the founding team. However, the founders acknowledged that as the USO grows and its operations become more complex, this reliance on flexible and low-cost labour gradually gives way to more specialized hiring, aligning with the broader shift toward structured workforce development described in section 4.4.3.

4.5.2 Investors influence leadership and strategic decision-making.

A critical moment in USO development occurs when investors start taking an active role in shaping the company's strategic direction. In five interviews, founders reported that once investors came on board, they began to actively influence key decisions, including the future leadership structure and the strategic direction of the company. Investors, driven by a strong focus on scalability and market success, often prioritized commercialization speed over technological development, which sometimes conflicted with the founding team's original vision.

This shift led, in three cases, to pressure for leadership changes, with investors advocating for a more commercially experienced CEO to either replace or complement the founding CEO or team. While such changes were seen as beneficial for accelerating market entry, several founders noted that this process also introduced tensions around decision-making authority and founder autonomy. As a result, founders had to adapt to new leadership dynamics, requiring them to balance external investor expectations with their vision for the technology and the company's long-term development.

4.5.3 Implications on team composition and its evolution

As USOs grow, strategic decisions around hiring and leadership play a key role in shaping team evolution. In the early stages, lean hiring strategies, such as using students or versatile early hires, help manage limited resources while advancing development. This phase often relies on flexibility over structure.

However, as the venture scales, hiring must become more specialized and aligned with operational needs. Structured recruitment of experts in business development, finance, and operations becomes essential to support growth and reduce bottlenecks.

At the same time, investor involvement often drives leadership transitions, with pressure to bring in commercially experienced executives. Founders who wish to retain control must proactively develop their leadership skills and prepare for shared or evolving leadership roles. These shifts highlight how both internal strategy and external pressures drive the ongoing evolution of USO team composition.

4.6 Reaching credibility on the market and further scaling

For USOs to transition from early-stage ventures to scalable businesses, credibility is essential for attracting investors, customers, and strategic partners. However, due to their academic origins, many USOs struggle with market recognition. The findings indicate two key strategies to overcome these challenges: (1) visibility-enhancing actions, which focus on increasing market awareness, and (2) legitimacy-enhancing actions, which build trust and validation among stakeholders.

4.6.1 Visibility enhancing actions

Building market credibility emerged as a universally important aspect according to all interviews, with every founder emphasizing the importance of actively enhancing their visibility to attract investors, customers, and partners. USOs often struggle with market visibility due to the novelty of their technologies and their academic origins, which can make them less familiar to industry players. One effective strategy, highlighted by some founders, is to leverage their university affiliation to boost initial credibility. Being linked to a well-respected academic institution provides instant legitimacy in the eyes of external stakeholders.

Additionally, founders consistently emphasized the importance of actively engaging in networking activities. Attending industry events, trade fairs, and conferences was reported as a valuable way to showcase innovations, build personal relationships with investors and customers, and establish market presence. Beyond physical events, the use of digital channels like LinkedIn was also highlighted as critical. One founder noted that maintaining a consistent online presence and actively sharing company updates helped to attract inbound investor interest. Even though this was stated in only one interview directly, this implies for all the USOs.

The data also revealed that companies that were getting noticed online typically had teams that had already hired a marketing professional to manage external communication. This finding reinforces that team composition directly supports credibility-building efforts, highlighting the importance of adding marketing expertise as USOs transition toward market entry and scaling.

4.6.2 Legitimacy enhancing actions

Since USOs typically emerge from technology-push innovations, rather than responding to existing market demand, they often struggle to establish early credibility and attract stakeholders. One approach mentioned in 3 out of 10 interviews was early customer engagement, where USOs actively involved potential customers in the development process. Founders who applied this approach explained that these direct interactions not only helped them validate the product and adapt the technology to actual market needs but also served as valuable trust signals for other stakeholders, including investors and partners. While this was not a universal practice across all cases, the interviews suggest that early customer engagement could represent a

highly valuable strategy for other USOs facing similar credibility challenges, especially those navigating the transition from research-driven development to commercial viability.

In addition to customer engagement, institutional backing from universities was consistently mentioned as a key legitimacy enhancer. Founders described how university involvement, through patent ownership, licensing agreements, or equity stakes, provided initial credibility, signalling that the technology had undergone rigorous academic validation. This institutional connection reassured potential investors that the innovation was scientifically sound and worth exploring further.

The data also highlights that certain founding team compositions contributed to perceived legitimacy. Investors and industry partners expressed greater confidence when technical experts and respected researchers were actively involved in or with product validation and external communication. This person's bounded credibility significantly strengthened the USOs' ability to present itself as a viable, scalable venture. This confirms that legitimacy is not only built through external communication strategies but also through the deliberate shaping of the team itself, reinforcing the central importance of team composition throughout USO development.

4.6.3 Implications on the team composition and its evolution

To support growth and build market credibility, USO team composition must evolve beyond technical expertise to include visibility- and legitimacy-enhancing roles. In the early stages, university affiliation and the presence of respected technical experts help establish initial legitimacy. However, as the company moves toward market entry and scaling, visibility becomes increasingly important.

This shift requires adding team members with skills in marketing, business development, and networking. Marketing professionals help manage external communication, online presence, and industry engagement, these are essential activities for increasing recognition among investors, customers, and partners. If these skills are not present in the founding team, they should be developed internally or introduced through strategic hiring.

At the same time, maintaining strong technical representation remains essential. Stakeholders are more confident when technical experts are visibly involved in product validation and communication. This blend of technical credibility and commercial outreach could strengthen stakeholder trust.

In sum, as USOs evolve from early-stage ventures to market-facing firms, their team composition must shift from purely technical to a balanced structure that integrates both scientific authority and market engagement capabilities.

4.7 Different development scenarios

As USOs move toward market entry and scaling, actively enhancing both visibility (through networking, marketing, and online presence) and legitimacy (through customer engagement, university backing, and credible technical leadership) helps build the credibility needed to attract investors, partners, and customers.

	Scenario A	Scenario B	Scenario C	Scenario D
Idea of company found during?	Academic research	Academic research	Academic research	Academic research
Research intention	Purely research	Doing research and looking to tackle a real-life problem	Purely research	Purely research
Trigger for commercial awareness	External stakeholders recognize potential after research.	Technical founder realizes commercial potential during research.	University and affiliated investors recognized commercial potential.	Experience private investor sees commercial potential during research
How is the business leadership gap addressed	Investors appoint external CEO as co-founder	Technical founder(s) learned business skills	Academic founder initially transitions into CEO, later, business specialist is appointed as CEO.	Experienced investor had business acumen
Timing of business expertise entry	External investors identify business gap and push for commercial co- founder	Gradually, when potential was found, business expertise joined as support, business expertise was developed by founder self with help of external expertise	Initially led by technical founder with the help of external business support. New CEO was introduced in a mid-stage to prepare for growth.	Immediately, business expertise present from day one through experience co- founder
Who initially took the role of CEO?	Initially dual leadership, but external co- founder takes CEO role	Technical founder	Technical founder	Surrogate entrepreneur, which is the experienced investor
Role evolution of technical founder	Remains CTO, technical focus is constant while	Evolves from pure technical role to CEO	Started as CEO transitions into CTO when	Remains CTO technical focus is constant

Table 2: Different development scenarios

UNIVERSITY OF TWENTE.

	business leadership stays with the investors or cofounder	taking full business leadership responsibility	external CEO is hired	while business leadership stays with the experienced co-founder
Investor involvement level	Active involvement: investors identify skill gaps upon business cofounders and help shape business strategy	Advisory role: investors act as mentors, supporting but not dictating leadership decisions. The founder retained control	Active involvement: investors actively drive leadership transition pushing for a new CEO when growth out basis founders' business skills	Active involvement + guidance: the investor-co- founder plays a hands-on leadership role as CEO and directly shape strategy and hiring
Leadership dynamics	Dual leadership at start, but surrogate entrepreneur takes over during venture development	Founder takes control and remains in control	Leadership transition: from founder to investors and new CEO	Investor takes role of CEO due to experience. Remains in control during development
Hiring strategy	Organic hiring: Only hiring when the need rises as the company grows	Organic hiring: Only hiring when the need rises as the company grows	Organic hiring: Only hiring when the need rises as the company grows	Strategic hiring: First building experienced management team, then focus on expanding technical team
Role of R&D in later stages	Due to surrogate entrepreneur, little R&D and more commercial	Remains important	Remains important	Remains important
Founders learning journey	Focuses mainly on technology learned some commercial skills through experience with cofounder	Actively seeks entrepreneurial knowledge (courses mentorship, hands-on learning) becoming a capable business leader	Attempts to gain business experience as CEO, but ultimately prefers technical role, leading to transition into CTO	Focuses entirely on technology from the start, leading all business responsibilities to experience co-founder.

4.7.1 Development scenarios and expected outcomes

The identified scenarios reveal that the approach taken in the early stages of the spinoff impacts its long-term development. Below, each scenario is analysed, highlighting the expected outcomes based on differences in their development paths.

Scenario A: balancing the technical founder with a commercial founder

In this scenario, the spin-off is initiated by a founder with a strong academic and technical background, who chooses not to lead the company as CEO. Instead, a commercially experienced CEO is brought in early to guide the business side. This early division of roles allows the company to begin with a solid technical base while simultaneously building commercial capabilities. The initial phase is typically slow, with an extended development period focused on product readiness. Once the business side gains momentum, however, growth can be rapid due to a clear product-market fit and strong execution on scaling.

"The founder was really a scientist, and I joined the company because they needed someone who understood the construction market" (SO1, interviewee)

Over time, the hired CEO becomes the central figure in the organization, and the founder may be seen as less valuable and be put into an advisory role. As commercial goals take priority, the company may invest less in ongoing R&D, becoming more reliant on the success of its first product. This approach can drive early market success but may limit adaptability and long-term innovation, especially in highly technical or dynamic markets.

"The contrast between business operations, commercial thinking, and scientific work is definitely a thing. The founder is very much a scientist... but if there's no real-world application, there's also no solution." (SO1, interviewee)

Secondary data analysis findings suggest that generally newly hired CEOs have little to no research background (indicated by low or no H-index) yet bring valuable market and operational experience. These CEOs tend to hire team members with similar practical profiles, which can reinforce a commercially driven company culture. While this accelerates business development, it often leads to a reduced focus on deep technical capabilities, which could hinder the venture's ability to remain competitive in research-intensive sectors.

"We deliberately took a practical approach and hired another acoustician with a more hands-on background." (SO1, interviewee)

Two possible outcomes of this scenario:

A1: Positive development path

The external CEO collaborates closely with the technical founder, recognizing the value of ongoing research and ensuring that innovation remains part of the company's long-term strategy. The team is built with a balance of commercial and technical talent, allowing the company to scale effectively while maintaining the ability to adapt and

evolve its product offerings. This balanced approach leads to sustainable growth and resilience in the face of market or technology shifts.

A2: Negative development path

The CEO prioritizes rapid commercial growth and sidelines the technical founder's input. The team becomes dominated by practical, business-oriented professionals, with limited technical depth. The company performs well initially, but with minimal investment in R&D, it struggles to innovate beyond its first product. When the market changes or competitors introduce more advanced solutions, the company lacks the internal capability to respond, leading to stagnation or decline.

Scenario B: Technical founder becomes the business leader

In this scenario, the academic founder starts with a strong technical and research background and gradually grows into the CEO role, developing business skills over time. Unlike scenario A, where a commercial leader is brought in early, or scenario C, where leadership transitions later, here the founder retains control of the company throughout its development. This allows for consistent strategic direction and strong alignment between the technical vision and business decisions.

"So R&D is fundamental and always remains part of the structure. Otherwise, you're a dead company." (SO7, interviewee)

"Now I am doing both CTO and CEO. But later, I will give the CTO to someone else... I want to keep CEO because otherwise, I lose control of the company." (SO10, interviewee)

The growth trajectory in this model is steady and strategic. The founder's learning curve in business leadership means the company doesn't scale rapidly at first, but decisions are thoughtful. R&D remains central, and the company often adopts a lean structure, hiring based on clear needs rather than aggressive expansion. This balance between innovation and business development creates a stable foundation for long-term success, provided the founder can adapt effectively to their dual role.

"Back then, I started with USO X completely green—I had no idea how anything worked. I barely knew what VAT was... and yet, all these years later, I've been the company's director from the beginning and still am today." (SO2, interviewee)

Secondary data analysis findings show that technical founders who stay on as CEO often have a medium to strong research background. These founder-CEOs tend to build teams that reinforce their scientific strengths, meaning that they often hire even stronger technical experts or forming scientific advisory boards. This supports a deep and continuous innovation process. However, making the transition from researcher to CEO requires support. Founders who succeed typically surround themselves with business advisors or co-founders who bring commercial expertise, ensuring that the company doesn't become overly academic or miss market opportunities.

"We had these courses in the faculty of Impact program... They showed us how to make a business model, calculate pricing, market fit, and more." (SO10, interviewee)

Two possible outcomes of this scenario:

B1: Positive development path

The founder successfully develops business acumen while continuing to lead the company. They form a strong team that balances scientific excellence with commercial insight, either by hiring business-oriented staff or working closely with external advisors. The company grows steadily, backed by continuous innovation and thoughtful market expansion, resulting in a technically advanced and commercially viable product portfolio.

B2: Negative development path

The founder struggles to adapt to the CEO role and resists bringing in business expertise. The company remains heavily research-oriented, with limited market traction. Although the technology may be advanced, the lack of commercial strategy and leadership flexibility prevents the company from reaching its full potential, and it risks becoming more of a research project than a scalable business.

Scenario C: founder starts as CEO but transitions to CTO

This scenario begins with the technical founder taking on the CEO role, guiding the company through its early development. However, as the venture matures and commercial demands increase leadership shifts: either the founder makes the shift to become CTO voluntarily, or investors initiate the appointment of a new CEO. This sets scenario C apart from B, where the founder retains leadership throughout, and from D, where a business expert is involved from the start. Unlike scenario A, where commercial leadership is introduced alongside the founder early on, this scenario represents a mid-stage restructuring that brings both opportunity and risk.

"I was CEO... in the end, I was CTO, the investors wanted a new CEO" (SO6, interviewee)

"Then a full-time CEO came on board... under his leadership, the company grew and became more mature." (SO4, interviewee)

The success of this model depends heavily on how the leadership transition is managed. A smooth handover can allow the founder to focus fully on innovation, while the new CEO drives market expansion. If the incoming leader shares the company's vision and is accepted by the existing team, the company can successfully scale without compromising its technical strengths. However, misalignment between the new CEO and the existing culture can create internal resistance, delaying decision-making and hindering commercialization. Cultural disruption, particularly when employees are loyal to the founder or rooted in an academic mindset, is a key challenge.

"Everyone needs to have the same mindset and point in the same direction... not to have people that pull in different directions" (SO6, interviewee)

Secondary data analysis suggests that individuals with a medium to strong research background tend to build academically oriented teams, prioritizing scientific rigor and

research expertise in their hiring. Conversely, leaders with little to no research background typically build more practical, business-oriented teams. In Scenario C, the company initially formed under academic leadership, resulting in a research-driven foundation. Because the external CEO is appointed later in the development process; rather than from the beginning, as in Scenario A; the company does not fully shift toward a purely market-oriented structure. Instead, the late introduction of a more business-minded CEO brings in some practical expertise, but the already established academic base ensures that the company remains balanced between scientific and commercial priorities. This timing creates a hybrid structure that reflects both the founder's academic roots and the later commercial push.

Two possible outcomes of this scenario:

C1: Positive development path

The external CEO gains trust within the company, working alongside the founder to balance technical depth with commercial strategy. The company retains its innovative capacity while shifting toward market readiness. The new leader respects the academic culture but introduces structure, focus, and business growth, creating a dual strength in R&D and commercialization.

C2: Negative development path

The new CEO fails to align with the technical team or is perceived as lacking credibility. Internal tensions arise, slowing progress and undermining confidence in leadership. The company becomes caught between its academic roots and new commercial goals, failing to execute effectively on either. As a result, scaling stalls, and the venture risks stagnation despite having a strong product.

Scenario D: Rapid growth due to an experienced founding team

This scenario is unique because the USO begins with both technical and business expertise in place from the outset. An experienced CEO is involved from the beginning, often alongside a technical founder, creating a well-balanced leadership team from day one. Unlike scenario A, where commercial leadership enters later, or scenario B, where the founder must grow into the CEO role, scenario D benefits from immediate business leadership and structured growth planning. Compared to scenario C, which undergoes a leadership shift mid-development, scenario D avoids instability by establishing a clear division of roles early on.

Companies following this model typically experience fast and well-organized growth. Early funding is often secured more easily due to the commercial credibility of the CEO, who guides strategic planning, team building, and market development from the start. The business side actively works to identify commercial opportunities and drive early revenue, while the technical team continues to develop the core product. This creates a strong alignment between innovation and execution, allowing for scalability without compromising the quality of the technology. However, the success of this approach hinges on the CEO's ability to integrate with the technical team and lead without creating internal conflict.



"What we did was decide early on: what are the basic roles we need to start this team... we quickly hired a COO, and then added someone for commercial tasks." (SO3, interviewee)

Secondary data analysis findings show that in these cases, the CEO often has a medium to low research background, but this is complemented with solid experience in business. This allows them to understand the importance of scientific rigor while also focusing on practical execution. These CEOs tend to build strategically balanced teams, adding scientific experts and advisory boards to maintain technical strength, while also hiring business professionals to build operational capacity.

"We established an advisory board very early on, consisting of external industry professionals who support us." (SO3, interviewee)

"They were all people with an engineering background... Master's and PhD degrees." (SO3, interviewee)

Two possible outcomes of this scenario:

D1: Positive development path

The founder and CEO align early on, each respecting the other's domain. The CEO builds a team that blends technical with commercial expertise, including scientific advisors, business developers, and operational specialists. With this structure, the company scales efficiently, reaches the market early, and maintains its ability to innovate achieving strong, sustained growth.

D2: Negative development path

The CEO introduces a new strategy and hiring plan but struggles to gain the founder's full support. Misalignment emerges over strategic direction or company priorities. Friction between the technical and business leadership slows down decision-making and stalls execution. The company may underperform despite a solid product, due to lack of cohesion at the top.



5 Discussion

5.1 Summary of the results

This study explored how team composition evolves within university spin-offs (USOs) as they develop from research-based projects into sustainable (growing) ventures. This study revealed several important findings about the evolving team composition of USOs. The aim of this study is to answer the research questions: *How does the team composition, evolve as University Spin-Offs (USOs) progress from the start toward the sustainable returns phase?*

The results of this study indicate that there is no static, universal team composition for USOs. Instead, team composition evolves dynamically, with successful USOs adapting their teams to fit the demands of each development stage. This requires balancing technical and business expertise, responding to external influences such as investors, and aligning team structure with shifting organizational priorities as the company grows.

5.2 Interpretation of results

The first important finding is that USOs mainly originate from academic research projects that focus on scientific goals rather than market needs. As a result, these USOs have a strong technical focus in their early stages, while their connection to the market is still limited. This finding was expected since it fits well with how USOs are typically described in the literature (Clarysse, 2000; Rasmussen et al., 2011).

This finding is also supported by many studies, which show that USO teams often consist of researchers, students, and professors who have strong technical and research knowledge but little experience with entrepreneurship (Hunady et al., 2019; Ortín-Ángel & Vendrell-Herrero, 2010). Interestingly, this technical focus is not necessarily a disadvantage. Research has shown that teams made up entirely of academic members tend to perform better in terms of innovation than teams that combine academics with business professionals (Ben-Hafaïedh et al., 2018). This makes sense because USOs rely heavily on their unique, research-based technologies to create a competitive advantage (Axelson & Bjurström, 2019)

At the same time, this strong technical focus does create challenges, which is why many studies have explored how to reduce these risks by improving the business and market side of USOs. For example, Brinckmann (2009) found that having team members with business experience can help USOs grow faster and achieve early sales. Similarly, Rasmussen and Wright (2015) showed that universities can play an important role by supporting USOs in their early development and helping them build stronger market connections. Even though these suggestions are valuable, they do not change the fact that most USOs still start from academic teams and scientific projects. This confirms that the strong technical focus is still a core characteristic of USOs, even if efforts to improve market alignment are increasing.

Based on finding one, the first following proposition can be formulated:

University Spin-Offs predominantly originate from academically driven research projects, resulting in early-stage teams with a strong technical orientation and limited market engagement, which, while fostering innovation, necessitates complementary strategies to address commercial gaps.

The second key finding is that external support, such as from Technology Transfer Offices (TTOs), incubators, or experienced external professionals, plays a crucial role in helping USOs bridge the gap between academic research and commercial success. This finding was expected, as many studies have shown that USOs benefit from structured support during their development (Wright, 2007). Especially in the early stages, incubators and TTOs help by providing business knowledge, teaching entrepreneurial skills, and connecting USOs to potential customers (Kirihata, 2024). In addition, external factors such as investors are also valuable because they not only provide financial resources but also enhance the credibility of the USO and offer important business networks, which are often lacking in purely academic teams (Del Sarto et al., 2025).

However, there is also a growing debate in the literature about whether all external support is always beneficial. For example, some studies argue that TTOs tend to focus too much on the technology itself, instead of developing the business side of the USO (Kirihata, 2024). This focus on technology can keep USOs too closely tied to the university environment, limiting their exposure to real market conditions. Furthermore, some researchers warn that incubator programs can create an "artificial survival" effect, where USOs appear to succeed inside the incubator but struggle once they leave (Kirihata, 2024). There is also evidence that USO founders who become too dependent on TTOs and incubators may lack the ability to operate independently in competitive markets (Hannibal et al., 2016).

Overall, this finding remains valid when considering the balance between receiving support and maintaining entrepreneurial independence. External support can clearly help USOs overcome some of their initial weaknesses, but it works best when it empowers founders rather than fully taking over the decision-making process. This highlights the importance of support programs that focus on gradually preparing USO teams to become self-sufficient in the market, rather than creating long-term dependence. Based on this second finding, the following proposition can be formulated:

External support mechanisms, such as TTOs, incubators, and experienced professionals, are critical in helping USOs transition from academic research to commercial viability; however, their impact is most effective when they empower entrepreneurial independence rather than create long-term dependency.

The third finding is that USOs benefit when their founders personally transition from being academic researchers to entrepreneurial leaders. This means they actively develop business skills, take ownership of the company, and find the right balance between learning new competencies themselves and asking for external help when needed. This finding was expected because several studies emphasize that this transition is crucial for USO development (Clarysse et al., 2011; Rasmussen et al., 2011)

Clarysse et al. (2011) describe how hiring an external CEO is often challenging for USOs, as external managers may struggle to gain acceptance from the founding scientists, or they may have a different vision for the company. Therefore, it can be more effective if the founder takes on the entrepreneurial role themselves. In addition, founders who show a strong willingness to learn and demonstrate adaptability are more likely to attract funding and other essential resources(Zahra et al., 2006). Rasmussen et al. (2011) also stress that this entrepreneurial transition is important for securing

financing and attracting skilled team members, both of which are crucial for USO growth.

However, not all studies fully agree with this view. Ben-Hafaïedh et al. (2018) found that USOs with mixed teams; combining academic founders with experienced business professionals, tend to perform better commercially than teams made up of only researchers or only practitioners. This suggests that while it is valuable for founders to develop business skills, adding external practitioners with commercial experience can still bring significant benefits to market performance.

In conclusion, this finding remains valid because the founders' personal development is essential for securing early resources and building the foundation for growth. At the same time, this does not mean that external business expertise should be avoided altogether. Instead, the key is to ensure that external business professionals complement, rather than replace, the entrepreneurial development of the academic founders themselves. This balanced approach allows the USO to benefit from both strong technological expertise and effective market orientation. Based on this third finding, the following proposition can be formulated:

USOs are more likely to succeed when academic founders personally transition into entrepreneurial roles, balancing internal skill development with complementary external expertise, rather than fully delegating leadership to external managers.

The fourth finding is that successful USO development benefits from a dynamic team composition, where the balance between technical and business expertise changes as the USO progresses through different growth stages. In the early phases, teams rely more on generalist roles where founders often take on multiple responsibilities. However, as the USO grows, the team gradually shifts towards more specialized roles, with a clearer separation between technical and business functions. This finding was expected, as several studies have already described the importance of adapting team composition to fit the changing needs of a growing USO (Boone et al., 2020; Clarysse et al., 2011; Visintin & Pittino, 2014)

Boone et al. (2020) highlights that two key types of competencies are critical for USOs: technical competencies, which are essential at the start, and founding competencies, which become increasingly important when the USO begins to commercialize its technology. This confirms that teams must evolve to stay aligned with the company's development stage. Clarysse et al. (2011) also emphasizes that the balance between technical and business expertise should shift over time, ensuring the team has the right skills at each phase. Similarly, Visintin and Pittino (2014) found that as USOs grow larger, they need more advanced capabilities, especially in areas like financial management, strategic decision-making, and organizational leadership.

In conclusion, this finding remains valid because it reflects the natural development process of USOs. The need for dynamic team composition is well supported, as early-stage flexibility is crucial for survival, while later-stage specialization helps the USO handle growing complexity and competition. Successfully managing this transition allows USOs to combine technological innovation with effective business execution, increasing their chances of long-term success. Based on this fourth finding, the following proposition can be formulated:

The successful development of USOs depends on a dynamic team composition that evolves from generalist, founder-driven roles in the early stages to increasingly specialized technical and business functions as the venture grows.

The fifth finding is that as USOs grow, they benefit from making smart, stageappropriate decisions about expanding their teams. This means they need to balance cost-efficient hiring, such as using student employees or leveraging personal academic networks, with attracting experienced talent who can help the company scale. At the same time, growing USOs must also prepare for the increasing influence of investors, who may push for faster commercialization and even leadership changes. This finding was expected, as several studies confirm that USOs face strong resource constraints and are often forced to find creative and affordable ways to build their teams (Almeida, 2022; Gbadegeshin, 2017; Hannibal et al., 2016)

One common strategy is for academic founders to rely on their university networks to recruit students or recent graduates, who are often willing to work for lower wages in exchange for valuable learning experiences within the USO (Gbadegeshin, 2017). Research also shows that USOs can benefit from flexible leadership structures, where the CEO takes on a dual role, combining strategic leadership with hands-on operational tasks (Sciarelli et al., 2021). In addition, many USOs actively try to avoid excessive external ownership, as this can lead to conflicts between investors' commercial focus and the founders' scientific or technological vision (Sciarelli et al., 2021).

However, not all literature fully agrees that limiting external involvement is the best approach. Some studies show that investors, especially venture capitalists (VCs), can bring important advantages, such as access to larger networks, business expertise, and additional funding. When external investors own at least 15% of the company, this can significantly improve the USOs' credibility with other stakeholders, such as customers and future investors (Almeida, 2022)

Overall, this finding remains valid because it highlights the need for balance. USOs should be careful not to give away too much control too early, to protect their long-term vision. At the same time, welcoming external involvement in a controlled way, especially when it brings valuable experience and networks, can help USOs accelerate their growth and overcome resource limitations. The key is for USOs to remain strategic about who they involve, when, and under what conditions. Based on this fifth finding, the following proposition can be formulated:

As USOs grow, strategic team expansion and selective external involvement are critical; balancing cost-efficient hiring with experienced talent and aligning investor influence with the USOs' long-term vision enhances growth while preserving core values.

The sixth finding is that as USOs approach market entry and begin to scale, actively improving their visibility and legitimacy becomes essential. This can be done through networking, marketing, strengthening the online presence, and engaging with potential customers. At the same time, credibility can also be enhanced through university backing and by showcasing strong technical leadership within the founding team. This finding was expected, as earlier research already highlighted the importance of social capital and networking for USOs (Shane & Stuart, 2002).

Shane and Stuart (2002) found that USOs with well-connected founders tend to have better market access and improved future performance. This is because early networks help USOs gain visibility and legitimacy, making them more attractive to investors, partners, and customers. In fact, the networks formed by the founding team in the early stages have been directly linked to better long-term outcomes, further underlining the importance of early relationship building. However, some researchers also warn that focusing too much on legitimacy-building could backfire. Over-investing time and resources into image-building or visibility campaigns can lead to misallocation of resources, where important operational or product development tasks are neglected (François & Philippart, 2019). Furthermore, legitimacy should be seen as a dynamic process rather than something that can be created instantly. This means that while building credibility early is helpful, it does not have to be perfected right from the start (François & Philippart, 2019).

Overall, this finding remains valid because visibility and legitimacy are essential for securing external support, whether from investors, customers, or partners, especially for technology-driven USOs that often struggle to gain initial trust. At the same time, this process must be carefully managed to ensure that the focus on credibility does not come at the expense of product development, customer validation, or strategic decision-making. Finding the right balance between early visibility efforts and internal capability-building is therefore key to successful USO growth. Based on this sixth finding, the following proposition can be formulated:

As USOs approach market entry and scaling, building legitimacy and visibility through strategic networking and credibility signals is essential, but must be balanced with internal development to avoid undermining operational progress.

5.3 Recommendations

Based on the findings of this study, several strategic recommendations can be made to help USOs manage their team composition more effectively across their development. These recommendations are aimed at USO founders, universities and support organizations.

Firstly, USO founders should be aware that starting with a team dominated by technical expertise can lead to critical gaps in business and market understanding. While deep technological knowledge is a core strength, it can also result in a disconnect between innovation and actual market needs. Founders need to recognize that they often begin with a product in search of a market, whereas in traditional ventures, it typically starts the other way around. This reversal requires them to consciously identify and address blind spots in market insight and to actively work on aligning their technology with genuine customer demand.

In addition, given the common absence of internal business capabilities in early-stage USOs, it is recommended that external support is brought in as early as possible. Universities, technology transfer offices (TTOs), and incubators should play an active role in connecting USOs with experienced mentors, entrepreneurial training programs, and advisors who can provide crucial commercial insights without imposing high costs. These external actors can help balance the team and guide early decision-making.

At the same time, founders themselves should not rely entirely on external leadership. Instead, they should be encouraged to develop their own entrepreneurial and business skills. This involves making a shift from being a subject-matter specialist to becoming a generalist who understands both the technical and commercial aspects of the business. This shift not only strengthens the founder's leadership capacity but also increases investor confidence in the founding team. Another key recommendation is for founders to view team composition as a dynamic and evolving process. In the earliest stages, technical expertise is indispensable; however, as the USO progresses toward market entry and growth, commercial skills become increasingly important. Therefore, the team must gradually shift its balance to reflect the changing needs of the venture, ensuring that the right mix of competencies is always in place.

Furthermore, USOs should be strategic in their hiring practices, especially when resources are limited. Rather than building a large team too early, it is more effective to recruit a few highly skilled individuals who can cover multiple roles. Leveraging flexible options such as student interns or short-term project hires can also help meet specific needs in a cost-effective way. As the USO grows, team specialization will naturally increase, but this should occur in response to clear developmental goals, not external pressure.

Finally, founders should actively work to build not only product visibility but also team credibility. Stakeholders, particularly investors, are more likely to trust a well-balanced team that combines strong technical know-how with commercial competence. USOs should ensure that some team members are comfortable with networking, storytelling, and public engagement, as these skills are essential for creating early traction and forging strategic relationships.



5.4 Theoretical implications

The findings of this study support Vohora et al.'s (2004) idea that university spin-offs (USOs) must overcome several critical junctures to successfully develop into sustainable businesses. However, this study adds to that by showing how team composition strategies play a key role in crossing these junctures. While Vohora et al. mainly focused on individual learning and the need for entrepreneurial competencies, this research shows that developing these competencies is also a team-level process. It is about adapting the team by bringing in the right people at the right time. This highlights that team evolution is a form of reconfiguring dynamic capability (Teece et al., 1997), where USOs need to constantly restructure their team composition and capabilities in response to new challenges, market demands, and investor expectations.

This research also adds to the literature on entrepreneurial team composition (Clarysse & Moray, 2004; Vanaelst et al., 2006). It shows that there is no single "optimal" team composition for USOs. Instead, the ideal team depends on the phase the USO is in and on its unique development path. Earlier studies stressed the importance of teams with both technical and business skills right from the start (Ensley & Hmieleski, 2005; Visintin & Pittino, 2014). This study, however, found that there are several different ways to develop the team, each with its timing and process for bringing in business expertise.

In addition, this study contributes to entrepreneurial learning literature by showing that USO founders develop entrepreneurial competence in two ways: either by learning business skills themselves over time (as seen in Scenario B), or by adding external business expertise to the team (like in Scenarios A and C). This shows that team composition is not just about balancing skills, but also about shaping how learning happens within the company.

Finally, this study links USO development to dynamic capability theory (Teece et al., 1997). It shows that the ability to adapt team composition over time is an important dynamic capability for USOs. By reconfiguring team roles, bringing in new skills when needed, and adapting leadership, USOs show they can stay flexible enough to survive and grow. This connection between team evolution and organizational agility gives new insight into how USOs navigate the complex process of moving from research to market success.



5.5 Practical implications

The findings in this study carry several practical implications for USO founders, TTO's, investors, and support organizations involved in the early development of spin-offs

Firstly, founding teams should prioritize the early inclusion of commercial expertise. While a strong technical foundation is vital, relying solely on this without complementary business skills can significantly hinder progress. Many USOs struggle with securing funding or achieving early market traction precisely because they postpone bringing in business-oriented co-founders or advisors. To mitigate this, founders should actively seek individuals with commercial experience from the start, rather than waiting until commercialization challenges emerge.

Secondly, the role of support organizations such as TTOs and incubators must evolve to better meet the specific needs of technical founders. Generic entrepreneurship training often falls short in addressing the real and immediate challenges USOs face. Instead, these organizations should offer tailored mentoring programs, provide access to commercial networks, and develop matchmaking initiatives that connect technical teams with experienced entrepreneurs or early-stage investors who can offer both strategic guidance and capital.

Thirdly, investors should revisit their assumptions and expectations around USO team development. Unlike conventional start-ups, USOs tend to follow unique and often non-linear development paths, shaped by the timing of commercial awareness and the founder's willingness to take on business leadership roles. As such, demanding immediate CEO replacements may not always be the most effective approach. Instead, investors could adopt more flexible support strategies, including gradual leadership transitions and hands-on business mentoring, tailored to the maturity and needs of each individual spin-off.

Fourthly, the study highlights that entrepreneurial learning is not a one-time requirement, but a continuous process, particularly for technically trained founders. Even if external business professionals join the team, founders must still develop a working understanding of commercialization to lead effectively and retain strategic influence. Without this, there is a risk that investors or external managers take over decision-making, potentially sidelining the original vision of the founding team.

Finally, these findings underscore that team composition is not a static feature, but a dynamic and strategic lever for growth. Founders and support actors alike should treat team development as an ongoing process that evolves in response to changing business demands. Those who embrace this adaptive view of team building, rather than treating it as a one-time setup, will be far better positioned to guide USOs through the uncertainties of early growth and toward long-term sustainability.



5.6 Limitations and future research

Like any study, this research has certain limitations that should be acknowledged. First, the research methodology relies on a qualitative approach, which inherently comes with some constraints. While qualitative research provides rich, in-depth insights into the USO development process, it lacks the ability to establish statistically significant relationships. As a result, the findings are less generalizable compared to those of quantitative studies.

The USOs that were selected for this study were active ventures, meaning that failed USOs were left out of this study; this introduces some selection bias, which could skew the findings toward a best practice.

Future research could investigate this by conducting a study with only failed USOs to see how their team dynamics changed and what changes were or were not made during their first steps.

The main guideline in USO development for this study is the Vohora et al. (2004) framework. While this study frames team evolution within this model, alternative USO development explanations might be overlooked. However, when choosing for the Vohora framework, alternatives have been identified and were purposively not chosen. Future research could study how USO teams evolve by using different theoretical frameworks. Alternative perspectives could provide new insights and help check whether the findings of this study hold up when viewed from a different angle. Furthermore, as new models for USO development are introduced in the academic literature, future studies could investigate whether the patterns found in this research still appear when applying these newer models.

Moving on to the data itself, some more potential limitations can be found. First, the quality of the data revolves around interviewee subjectivity. Responses can be influenced by personal biases, memory recall issues since the participants must recall past scenarios, and maybe even social desirability since they talk about their own company. Founders may unintentionally present events in a more favourable light or struggle to accurately recall past decisions and team changes.

The interview data collected for this study were analysed using the Gioia method. The decision to conduct semi-structured interviews was made because this approach allows participants to share detailed stories and provides space to capture important nuances that might otherwise be missed. However, during the coding and categorization process, some of these nuances may have been simplified, generalized, or lost as the data were grouped into broader themes. Additionally, the process of qualitative coding introduces the possibility of interpretation bias, as the researcher plays a central role in interpreting and defining the first-order codes, second-order themes, and aggregate dimensions. As a result, subjectivity is inevitably part of the analysis, since the final themes reflect the researcher's interpretation of the data.

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Appendix A: Interview guide

1. Introduction (5 minutes)

- My name is Robin
- I am working to get my master's degree in business administration with the specialization on Entrepreneurship and innovation
- The topic of my study is USO success factors, specifically looking at team compositions as University Spin-offs grow
- Why this is interesting? Many Spin-offs fail to grow, which makes groundbreaking idea's unused and put back on the shelf. Furthermore, new companies can spur the regional economy, etc. One of the main factors that is linked to USO success and growth is having a good team, meaning heterogenous, and a mix between skills. But when do you need what skills?

How is the data used

If you agree, I'd like to record this session. The recordings will be handled confidentially. Only my supervisor and I will have access to the raw data, which will be fully anonymized.

I will use your input to find common topics among other Spin off founders and I hope to identify common themes among the different stages.

The interview itself

This is a semi-structured interview, so while I have some guiding questions, we will dive deep into key areas as needed. The interview should take no more than one hour.

During the interview we will discuss the following themes:

- 1. Your background and introduction of venture
- 2. Identification of the USO development stages and how you've moved through these
- 3. Challenges in growing and how the team helped in this

Recording:

Are you OK with me recording this interview? *start recording*

2. Participant background (5 min)

Objective: Establish the context of the spin-off and its founder(s)

- 1. Can you tell me about your Spin-off: when was it founded, and what problem or opportunity does it address?
- 2. How many founders were involved at the start, and what were their backgrounds?
- 3. What is your short- and long-term vision of the spin off?



3. USO phase according to the Vohora model (30 min)

Objective: Determine if they recognize the Vohora model and in which phase they're in currently

- 1. Do you recognise the USO development phases and that you progressed through these phases? Or do you have an alternative view on these phases/ certain phases?
- 2. Which phase of the development model would you say your USO is currently in? and why?

Research phase

Objective: Understand the origin of the idea and the academic groundwork

Explanation of the phase: this is the starting point, where focus is on academic or scientific research. You are exploring an idea or technology but have not yet considered its commercial application

- 1. Can you describe the research that led to the idea for this spin-off
- 2. Who was involved during this phase, and how did they contribute to developing the research?

Opportunity framing phase

Objective: Understand initial team formation and recognition of the business idea *Explanation of the phase: In this phase, you begin to assess the potential of your research. You are identifying a market need and evaluating whether your idea or technology can address it effectively*

- 1. How did you recognize the potential to commercialize your research?
- 2. Who was involved in framing this opportunity, and what were their roles?
- 3. Looking back, was the team composition at this phase well-suited to frame the opportunity? Why or why not?

Pre-Organisation phase

Objective: Examine team evolution as the spin-off transitioned into a formal organization

Explanation of the phase: here, you start to take initial steps toward building a business. This included defining your value proposition, forming a team, and securing early resources of funding.

- 1. At what point did you start formalizing the spin-off into an organization?
- 2. How did the team change during this stage (e.g. new hires, roles becoming clearer, shift in team roles?)

- 3. Were there specific challenges that required changes in the team composition?
- 4. How did the team dynamic shift as the spin-off grew during this phase?

Re-orientation phase

Objective: Explore critical changes in the team during moments of pivot or challenge

Explanation of the phase: This is a critical stage where you encounter challenges or gaps, often when customers aren't responding to the product, resourses are running low, or the strategy no longer feels sustainable. You may need to pivot, adapt your strategy, or refine your product to better align with market needs.

- 1. Did your spin-off experience any major turning points or pivots in this phase? If so, what were they?
- 2. How did the team composition or roles change in response to these challenges?
- 3. Did any team members leave or join during this phase? What impact did that have?
- 4. What skills or roles became most critical at this point in your development?

Sustainable returns phase

Objective: Assess the current team composition and its role in long-term success

Explanation of the phase: You have a well structured organization, a clear business model, and a product or service that generates consistent revenue and growth. Your USO is now sustainable and saleable.

- 1. Can you describe your team as it exists today? What roles are present
- 2. What challenges are you currently facing, and how is your team addressing them
- 3. Looking back at the earlier stages, what do you think were the key moments where team composition influenced your ability to move forward?
- 4. How do you see your team composition evolving in the future?

4. Challenges during growth (15 minutes)

Objective: Find out how the team composition has facilitated during the different phases in handling challenges.

Opportunity recognition



Meaning: Identifying a market need that your idea or technology can solve. It's when your research connects to real-world demand.

1. What was, according to you, a specific skill or expertise that was crucial in identifying the opportunity

Entrepreneurial commitment

Meaning: Deciding to fully pursue your business idea, like forming a team or seeking funding. It's the move from planning to action.

1. How did the team manage to stay motivated and committed during at the start of the business?

Threshold of credibility

Meaning: Proving your idea works through prototypes, early customers, or investor support. It's about building trust.

- 1. How did you secure funding, and were there team members that played a pivotal role in this process? Why were their roles pivotal?
- 2. How did the company-built credibility, and were there specific roles that contributed to this?

Threshold of sustainability

Meaning: Ensuring your business is stable and growing, with a clear model and consistent revenue. It's long-term viability.

- 1. Which roles in your team were essential in scaling the business and ensuring stability?
- 2. Did you encounter challenges when adapting roles or expanding the team to meet scaling needs?

5. Reflection and recommendations (<5 minutes)

Objective: Gather insights and lessons learned from the founder's experience

1. Reflecting on your spin-offs journey, what would you do differently in terms of team composition throughout the development?

6. Closing (<5 minutes)

1. Would you like to add some additional details that you find relevant, but we did not discuss them yet?

That was the interview, I will stop the recording now. *stop recording*

Appendix B: Analysis H-index of USO teams

Research background is determined based on the H-index retrieved from the researcher's Scopus profile. The following classification is used to rank the scores: H-index 0-1 = weak, 2-5 = medium, 6 or higher = strong. This scale is based on the distribution observed across the sample.

			Research background			
SO	Founder role	CEO	СТО	Employees	advisory board	Observed pattern
1	СТО	weak	medium	weak	no advisory board	CEO with weak / no research experience builds practical team
2	CEO	strong	strong	medium - strong	strong	Research driven founder-CEO builds scientific team
3	СТО	medium	medium	medium	strong	Team with mix of scientist and business
4	СТО	weak	strong	strong	no advisory board	initial academic, later business, makes balance
5	CEO	weak	weak	weak	no advisory board	little research experience builds team with little / no research experience
6	СТО	weak	medium	medium	no advisory board	initial academic, later business, makes balance
7	CEO	strong	strong	strong	no advisory board	Research driven founder-CEO builds scientific team
8	СТО	weak	medium	weak	no advisory board	CEO with a weak / no research experience builds practical team
9	CEO	medium	medium	medium	no advisory board	Aiming to become scientific rigor
10	CEO	medium	strong	strong	strong	Research driven founder-CEO buids scientific team