Embedding Knowledge Management in R&D Capability Transformation in Software Startups

Nabil Georges Badr[a]
Independent Researcher and Engaged Scholar, Jacksonville, U.S.A.

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Abstract: Organizational development drives growth, especially for startups. This study presents a longitudinal action research engagement exploring the strategic integration of Knowledge Management (KM) practices within Organizational Development (OD) initiatives to catalyse scalable transformation in a software startup. Grounded in dynamic capability theory and implemented through the continual improvement framework, the intervention addressed operational inefficiencies, role ambiguity, and delivery challenges across R&D functions. By layering KM methodologies, such as centralized repositories, stakeholder-driven assessments, and iterative feedback loops into OD processes, the engagement reconstructed team structures, codified decision-making routines, and fostered a culture of collaborative innovation. Through cross-functional restructuring, strategic role definition, and embedded governance practices, KM was operationalized as both an infrastructural asset and a dynamic capability enabler. The findings underscore KM's pivotal role in enhancing adaptability, aligning leadership vision with execution, and sustaining high-performance trajectories under volatile growth conditions. This research contributes to startup literature by framing KM not merely as a support function, but as a strategic lever for organizational resilience, learning, and value creation.

1 INTRODUCTION

In today's volatile and fast-paced startup ecosystems, strategic organizational development (OD) has emerged as a critical determinant of sustainable growth and innovation (Cantamessa et al., 2018). Startups, particularly those in software development, are uniquely challenged by the need to rapidly scale operations while navigating resource constraints, fragmented workflows, and evolving market expectations (da Silva et al., 2021). These pressures are compounded by underdeveloped team structures and ambiguous role definitions, often hindering performance and resilience during crucial growth phases.

Generally, Research and Development (R&D) functions serve as the strategic nucleus for software startups, positioning knowledge creation and integration at the center of capability transformation. Yet, to unlock the full potential of R&D contributions, startups must engage in intentional OD practices that harmonize human, procedural, and technological assets. Knowledge management (KM) thus becomes indispensable—not merely as a tool for operational efficiency, but as a socio-technical framework for cultivating dynamic capabilities (Alavi & Leidner, 2001), institutionalizing learning (Nonaka, 2009) (Nonaka & Takeuchi, 1995), and driving organizational renewal (Ren & Argote, 2011).

Effective KM methodologies enable startups to transform tacit insights into actionable routines, thereby enhancing collaborative engagement and innovation throughput. Practices such as centralized repositories, iterative feedback loops, and cross-functional learning rituals support adaptability while mitigating knowledge fragmentation. When embedded within an OD strategy, KM not only elevates execution but serves as a strategic lever for resilience and value co-creation (Bharadwaj et al., 2015).

This paper presents a longitudinal action research case study exploring the strategic deployment of KM methodologies to catalyze organizational transformation in a scaling software startup. Guided

[a] https://orcid.org/0000-0001-7110-3718

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by continual improvement processes and grounded in OD theory and capability lifecycle models (Adelman, 1993; Coghlan, 2019), the study demonstrates how knowledge-led interventions, aligned with leadership priorities and customer-centric design, can unlock measurable improvements in delivery, innovation, and operational alignment. Through an integrated framework, the paper illuminates how KM functions as the cornerstone of sustainable growth in emergent organizational settings.

2 BACKGROUND

2.1 Organizational Development in Startups

In highly dynamic startup ecosystems, organizational development (OD) emerges as a deliberate, theory-driven intervention to foster capability building, improve process maturity, and align culture with strategic objectives. OD originated as a planned, long-term effort to enhance an organization's renewal processes through applied behavioral science and change-agent facilitation (Beckhard, 1969). Over time, OD theories have evolved to address both stability and change, integrating concepts of learning, resilience, and adaptability, qualities vital for young ventures navigating uncertainty (Garengo & Bernardi, 2007).

Startups differ from established firms in that they operate under extreme resource constraints, accelerated growth expectations, and evolving business models (da Silva et al., 2021). These conditions frequently give rise to fragmented workflows, role ambiguity, and ad hoc decision making, which can derail performance and inhibit scaling (Giardino et al., 2015). Early OD efforts in startups must therefore emphasize structural clarity, process standardization, and team capability development to mitigate the high failure rate observed in the first five years of operation (Cantamessa et al., 2018).

2.2 Essential KM Practices for OD

Within OD, continuous improvement models offer a structured lens for integrating KM into transformation efforts. Organizational development practices prescribe learning cycle, for example, prescribes iterative phases of assessment, intervention, and monitoring, enabling startups to validate knowledge-led changes and calibrate interventions in real time (Beckhard, 1969). Similarly, action research methodology, rooted in practitioner inquiry and collaborative problem solving, has been successfully applied to guide iterative OD interventions where KM artifacts, such as dashboards and knowledge maps, serve as both diagnostic and change-management tools (Coghlan, 2019).

Knowledge management (KM) practices complement OD by offering systematic practices to capture, codify, and disseminate both tacit and explicit knowledge, thereby institutionalizing learning and driving dynamic capabilities (Nonaka, 2009). In nascent ventures, where knowledge resides disproportionately with founding teams or key technical experts, KM practices such as centralized repositories, collaborative rituals, and feedback loops become foundational to preserving critical insights and preventing knowledge loss as teams expand (Badr, 2018). KM frameworks rest on socio-technical foundations, recognizing that people, processes, and technology must coalesce to enable effective knowledge flows (Ren & Argote, 2011). For startups, embedding KM as a socio-technical system within OD interventions ensures that knowledge-centric routines—such as design reviews, post-mortems, and best-practice coding standards—are not peripheral activities but core organizational processes that reinforce innovation and operational consistency (Bharadwaj et al., 2015).

2.3 KM as Dynamic Capability

A stream of research highlights the linkage between KM capabilities and organizational performance in technology-driven contexts. For instance, startups that invest in knowledge repositories and collaborative platforms report faster product iterations and improved cross-functional coordination, leading to shortened time-to-market and enhanced customer responsiveness (da Silva et al., 2021). These findings underscore the dual role of KM in driving both efficiencies through process codification, and innovation via knowledge recombination and serendipitous learning.

Dynamic capabilities theory further articulates how firms sense opportunities, seize resources, and transform operations to maintain competitive advantage. In startup settings, the integration of KM within OD reconstructs routines that underpin dynamic capabilities, such as rapid prototyping, customer-centered iteration, and ambidextrous exploration, thus enabling ventures to pivot effectively and sustain value creation under volatile market conditions (Badr, 2018).

Empirical studies of startup transformations

reveal that leadership commitment and cultural alignment are critical precursors to KM-driven OD success. Founders and early executives must model knowledge-sharing behaviors, allocate resources for knowledge infrastructure, and incentivize cross-team collaboration to overcome the inertia of informal practices (Bharadwaj et al., 2015). Without this sponsorship, KM initiatives risk devolving into disconnected artifacts rather than becoming integral elements of organizational capability. As startups scale, the interplay between KM and OD influences talent management and organizational architecture. Role clarity exercises (e.g., RACI matrices) and competency taxonomies help delineate responsibilities, reduce overlaps, and foster accountability (Garengo & Bernardi, 2007). Concurrently, knowledge bases must evolve to support branching capability lifecycles—retiring obsolete practices, renewing critical skills, and redeploying intellectual assets into new product domains (Badr, 2018).

Notwithstanding these benefits, startups face barriers in operationalizing KM within OD. Common challenges include limited change-management expertise, competing short-term priorities, and technology adoption hurdles in resource-constrained environments (Okanović et al., 2020). Addressing these obstacles requires a phased approach: initial low-overhead practices (e.g., peer reviews, learning retrospectives), followed by incremental investments in digital platforms, and culminating in governance structures, such as change control boards and design councils, that institutionalize knowledge flows (Tunnicliffe et al., 2021).

3 APPROACH

Our study builds on this rich theoretical and empirical foundation by examining how an 18-month, action-research–driven OD initiative leveraged integrated KM methodologies to transform a software startup's R&D capability. Informed by OD principles, the intervention prioritized leadership engagement, customer-centric assessments, and the establishment of a central knowledge base. By synthesizing continuous improvement cycles with dynamic capability theory, the case illustrates how KM can function as both catalyst and enabler of startup resilience, innovation, and scalable performance.

3.1 Case Study Setting

The General Manager of Company X commissioned us to investigate and recommend measures to address the dual demands of sales oversight and growth acceleration at the three-year-old startup. At that point, Company X, a software development firm holding significant government contracts and guided by a proactive leadership team, employed 48 full-time staff. Its structure included a small sales force, an operations unit responsible for logistics, project management, and post-implementation support, and a 16-member R&D department charged with core software development and solution delivery. Although a human resources team handled recruitment and compensation, organizational development efforts were ad hoc, making sustainable expansion feel out of reach. The GM had growing concerns about R&D's performance, chronic project delays, uneven team output, blurred role definitions, and uncertainty around deliverable statuses for key clients. The engagement was thus designed to achieve three strategic goals: enhance delivery capability and precision, establish long-term revenue growth, and strengthen the startup's competitive position.

3.2 Engagement Summary

Following initial scoping sessions with the General Manager and R&D Director, we structured the engagement into three concurrent streams, each with defined deliverables (see Figure 1).

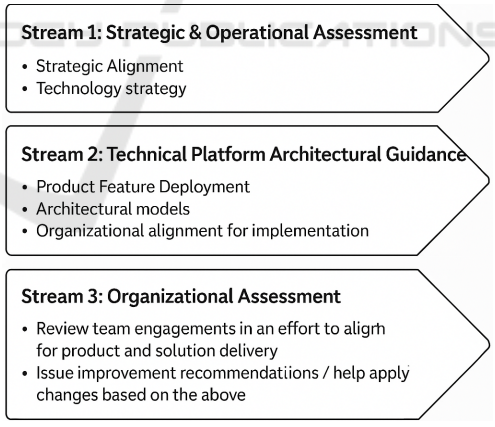

Figure 1: Company transformation engagement of three parallel streams of activities.

Stream 1 – Strategic and Operational Assessment: This stream carried out a thorough review of the company's strategic initiatives and operational practices. Activities included clarifying strategic objectives, auditing active projects, and vetting future opportunity pipelines. We also mapped technology strategy gaps and adjusted pre-sales proposals to better match market demands. From these insights, we

formulated targeted improvement recommendations and implemented changes to bolster strategic coherence and operational efficiency.

Stream 2 – Technical Platform Architectural Guidance: Here, we evaluated the deployment readiness of core technical components and tackled client challenges by introducing automation and agile practices. We developed and refined product architecture models to align with organizational standards and support seamless implementation. Additionally, we delivered a modular platform blueprint for future product launches, balancing architectural rigor with project oversight.

Stream 3 – Organizational Assessment: Focused on optimizing how the company delivers products and solutions, this stream reviewed team structures and processes against delivery objectives, then issued prioritized recommendations for improvement. Over an 18-month period, we tracked and evaluated the implementation of those changes to ensure ongoing organizational refinement and sustained performance gains.

We conducted our longitudinal case study centered on the organizational assessment stream (stream 3). This paper however uses insights from streams 1 and 2 were instrumental in framing the broader transformation effort in framing the broader transformation effort.

3.3 Empirical Inquiry

Once leadership endorsement was secured, the process began in three cycling stages (Figure 2).

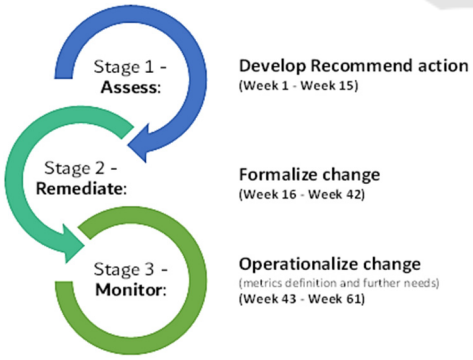

Figure 2: Continual organization improvement ARM process (by the author Inspired by the learning cycle of continuous improvement (Tunnicliffe et al, 2021).

The first stage, Assess, focuses on initial information gathering aimed at surfacing tacit knowledge and structuring organizational insight into actionable recommendations. This foundation guides the second stage, Remediate, which involves the formalization and implementation of proposed changes derived from the assessment phase. Finally, the Monitor (Third) stage encompasses the operational rollout, the definition of performance metrics, and the ongoing evaluation of effectiveness, often triggering a return to the Assess phase for additional data collection and refinement. The three stages repeated iteratively as fresh data continually refined each cycle.

At the outset, we convened with the General Manager and the engagement sponsor to agree on our methodology, action plan, and desired outcomes. This kickoff meeting framed the initiative as a formal improvement effort, fostered trust across the organization, and created a safe space for open dialogue (Table 1 for the action plan details).

Table 1: Action Research - Organizational development Activities Calendar.

TIMELINE	ACTIVITIES
WEEK 1	**Launch Stage 1 - Assess: (Initial Assessment)**
WEEK 2	Perform initial operational assessment
WEEK 3	Review Employees Personality Tests conducted by HR upon hire in order to realign team structures as required.
WEEK 5	Focus on R&D organization - Conduct Team Climate survey and 1:1 exploratory interview and produce detailed transcripts
WEEK 9	Complete Assessment and Issue report
WEEK 10	Review report with stakeholders
WEEK 13	Communicate the report's findings to the teams and review the recommendations for final feedback
WEEK 16	**Launch Stage 2 - Remediate: Formalize the changes proposed in Phase 1**
WEEK 40	Complete activities for transformation (see stage 2 activities)
WEEK 42	Review progress with stakeholders and decide on next action. Through interviews with middle managers and an assessment by HR and General manager.
WEEK 43	**Launch Stage 3 - Monitor:** Operationalize the changes and assess further organizational needs. It was determined that another extension is required to anchor the changes and assess further organizational needs of operating, business and functional units.
WEEK 62	Contract was terminated early due to the completion of the duties required and the promotion of the essential GM stakeholder to a new position. Another contract was setup for other objectives of strategy and corporate level development.

3.4 Assess (Stage 1)

During Stage 1 (Assess) we partnered with the GM and R&D director to conduct an in-depth review of the R&D division, then planned to extend the process to other departments by defining interdepartmental metrics that would feed into companywide performance evaluations.

In Week 5, we dedicated a full day to capturing each of the 16 R&D team members' "voice of the customer" through individual, 30-minute, conversational interviews. Participants were prepared to share (1) their current tasks and priorities, (2) projects underway, and (3) challenges they wanted addressed. We probed deeper on recurring themes, distilled the main improvement ideas, and validated them with R&D leadership.

All interview transcripts were retained to preserve the authenticity of their input. Transcripts were retained to safeguard organizational memory and validate insights with leadership. We triangulated findings using transcript coding, HR personality assessments (reviewed post-analysis to avoid bias), and alignment checks between challenges and self-proposed solutions, marking initial knowledge structuring efforts.

We then conducted data analysis in three phases.

First, we coded each transcript for team assignment, role, responsibilities, and feedback, supplementing it with my observational notes. Second, we reviewed employee personality assessments from HR—conducted at hire—to contextualize team dynamics, deliberately analyzing our interview data first to avoid bias. Third, we compared informants' reported issues with their own suggested remedies, using this alignment as a proxy for willingness to change. Finally, we clustered feedback into key observations and action items.

In summary (Table 2), team members cited poor communication and visibility, particularly around feature handoffs between PMO, R&D, and Operations.

The assessment revealed lack in role clarity. The R&D director had grown the team reactively, leading to duplicated responsibilities across two product-focused subgroups, quality and delivery problems, cost overruns, and elevated risk to customer satisfaction and reputation.

Process handoff issues were reported. Process handoff issues between PMO, R&D and Operations were complicated with the lack of knowledge management and documentation: there was no clear insight regarding what features are currently being implemented and how they work, leading to surprises with the clients. Processes covering release management lacked defined timelines and scope controls, resulting in surprise deliverables and inconsistent quality.

Table 2: Points of feedback from the data collection.

Observation	*Feedback from the data collection*
Communication and reporting issues	*"Total lack of communication from the R&D team"* *"Lack of visibility from upper management regarding all activities with the R&D team."*
Process handoff issues	*Process handoff issues between PMO, R&D and Operations: no insight regarding what features are currently being implemented and how they work, leading to surprises with the clients*
Diminished ability to deliver	*Release management misalignment with desired product objectives and customer expectations: no time scope and expected release date of new features.*
Quality issues	*"Quality assurance reviews are not effective: serious lack of quality, due to the fact that some features get implemented without documentation and in-depth analysis of the feature".*
Role clarity	*Empowerment of PMO is lacking - Ambiguous role and authority of PM regarding all R&D functions - no respect for deadlines, with no heads up regarding any causes of delays*

By the end of **Week 9**, we compiled our assessment into a report outlining our findings and the recommended next steps.

In **Week 10**, the GM convened stakeholders to review and refine the report.

We performed an initial, SWOT analysis, highlighting strengths (S), challenges (Weaknesses), leadership imperatives (Opportunities), and priority fixes (Threats). This analysis is a strategic planning tool used to identify and evaluate an organization's internal Strengths and Weaknesses, alongside external Opportunities and Threats, to inform decision-making and goal setting.

By **Week 13,** we presented the finalized SWOT-driven recommendations. in a feedback session. These high-level delivery process proposals aim to improve client engagement, streamline operations, and support sustainable growth.

3.5 Formalize the Organization (Stage 2)

Beginning in **Week 16,** we collaborated with middle management and HR to translate the assessment findings into concrete interventions.

Remediation activities were organized into repeating cycles of action and feedback, ensuring that each iteration was built upon the last. Below is a summary of the principal initiatives:

First, we facilitated a RACI analysis across the organization to delineate responsibilities, eliminate overlaps, and sharpen accountability—particularly distinguishing between "solution development" and "product packaging," with the PMO orchestrating their intersection. The RACI workshops clarified responsibilities and surfaced latent organizational knowledge. A RACI matrix stands for Responsible, Accountable, Consulted, and Informed is a structured responsibility assignment tool used in project management to clarify roles and streamline decision-making across tasks. It helps prevent ambiguity by explicitly mapping each activity to stakeholders based on their level of involvement.

Under the existing R&D director, the original group split into Integration (requirements and design), Customization (development and configuration), and Delivery (QA and release management). Each pod adopted two-week Agile sprints to accelerate feedback and defect detection. Agile pods accelerated knowledge loops through biweekly retrospectives and sprint-based reviews.

Based on the RACI outcomes, a decision was made to add two new roles to close apparent gaps. One role was a Solutions Architect to formalize design rigor before client handoff, and a dedicated PMO lead to smooth engagement transitions and reinforce project governance. In partnership with HR, we redesigned job profiles into three tiers (e.g., Junior, Mid-level, Senior Developer) and accelerated hiring for both new and backfilled roles. This tiered structure clarified career paths and fostered cross-disciplinary skill building.

We then established a formal communication plan between the R&D team and the PMO, and project managers were empowered to own scope, timelines, and customer satisfaction throughout solution delivery. The addition of a Solutions Architect role institutionalized design knowledge and ensured rigor prior to handoffs. The PMO Lead role served as a conduit for codified best practices and client-facing insights.

3.6 Operationalize Change (Stage 3)

From **Week 43** onward, we maintained an ongoing cycle of observation and adjustment to guide a sustainable transformation. The latter requires more than strategic intention, it demands robust change governance frameworks that align institutional structures, stakeholder engagement, and adaptive learning processes. This is particularly critical in dynamic environments where transformation efforts often falter due to fragmented leadership or lack of accountability (Rieg et al., 2021).

Hence, building on the assessment, we set out to formalize our improvements. We convened a cross-functional steering committee which met biweekly to track progress and resolve roadblocks.

Two formal committees were established: a Change Control Board to vet all internal and external modifications, and a Design Review Committee to ensure adherence to standards and client requirements. These forums were structured to meet regularly an embed learning and continuous improvement. KM was embedded directly into delivery processes and formalized through the Design Review Committee and Change Control Board, establishing knowledge as a governance asset.

We codified an end-to-end delivery process aligned with the new team structure, supplemented by practices of change management to support adoption.

After reviewing options, we configured Jira (integrated into a KM platform, Confluence) to automate workflow tracking, deliverable reporting, and quality dashboards, thus reducing manual status updates and enhancing visibility across stakeholders.

These mechanisms provided operational structure and a sustainable change platform, allowing the organization to store, share, and act on its collective insight. Leveraging the same Atlassian suite, we built a centralized repository for design documents, best practices, and feedback loops, enabling faster decision-making and safeguarding institutional memory. The deployment of Jira and Confluence created a living repository for design assets, delivery templates, and continuous feedback, bridging departmental silos and enhancing real-time decision-making.

Throughout this phase, we addressed individual resistance through one-on-one coaching and customized adoption plans. As role clarity improved and new hires completed training, team cohesion strengthened. On **Week 40** the organization was realigned with measurable performance gains.

During **Week 42** progress review, stakeholders elected to extend the engagement briefly to consolidate these changes into a sustainable plan for the next product-line rollout.

Our initiative then focused on reinforcing KM through performance metrics, coaching, and adaptive monitoring. In collaboration with senior stakeholders, we defined clear organizational objectives and designed measurement methods to track progress

against both top-down and cross-functional targets. Performance dashboards and centralized documentation created a feedback-rich environment that supported iterative refinement and innovation. Team performance goals were tied to metrics reflecting cross-team achievements, reinforcing a culture of shared success. These metrics were incorporated into regular performance appraisals, ensuring continuous monitoring and improvement.

Critical information became instantly accessible through the knowledge repository, improving onboarding and sustaining project momentum as the organization scaled. Embedding knowledge management practices created real-time feedback loops and performance dashboards that fueled innovation, collaboration, and iterative refinement. A centralized knowledge repository made critical information instantly accessible and kept documentation up to date.

By **Week 60**, the company had won two substantial government contracts, requiring the addition of roughly 70 new employees. The prior organizational transformation strengthened the firm's dynamic capabilities, enabling it to absorb this rapid growth with minimal disruption. The structured KM tools enabled transition of knowledge to the new team and powered their productivity.

3.7 Celebrating Success

Our intervention markedly altered the company's performance trajectory. Within 90 days, a previously stalled development initiative was revived, reputational risk was mitigated, customer confidence was restored, and the firm recovered $2 million in lost revenue.

On **Week 62**, we formally closed the action research engagement—with a celebratory "*cake ceremony*", having met our transformation objectives.

Although the formal OD activities concluded, the organization continued to pursue strategic and corporate goals under a continuous-improvement ethos. The organization had realized significant gains, reviving stalled projects, recapturing revenue, restoring stakeholder confidence, and winning major contracts. The final celebration marked not just the completion of a formal OD engagement, but the emergence of a knowledge-led enterprise.

While classic OD principles provided a framework for change, it was the intentional layering of KM, from tacit insight capture to automated repositories and governance integration, that ultimately powered adaptability, alignment, and innovation. KM transformed scattered data points into a strategic resource, elevating both human and organizational potential.

In the weeks that followed, the GM was promoted to oversee the holding company, underscoring the lasting impact of our organizational transformation effort.

4 CONCLUSION

Our approach was built upon the foundational elements proven to drive successful organizational transformation (Beckhard, 1969): steadfast leadership engagement, a clearly articulated vision, structured change-management processes, a customer-centric and adaptive culture, seamless technology integration, ongoing improvement cycles, with decision making grounded in data.

4.1 Strategic KM as Catalyst for Startup Growth

Success in OD hinges on the startup's ability to translate evolving insights into scalable practices. As demonstrated in our case study, embedding robust KM practices and empowering the human capital were strategic imperatives.

Startups that prioritize early investment in KM frameworks and choose enabling tools with intention set themselves apart. Proper KM empowers teams to harness institutional knowledge, reinforce accountability, and sustain adaptive capacity as scale increases. With a unified knowledge base powering decision-support tools, automation, and feedback mechanisms, startups transform insight into action, continuously.

Selecting appropriate KM tools, those aligned with the organization's values, workflows, and culture, ensures that knowledge capture and retrieval are frictionless. Whether through integrated platforms for real-time collaboration (e.g., Notion, Confluence), advanced tagging and semantic search engines, or lightweight consensus and annotation layers for distributed decision-making, these tools shape how effectively organizations learn and adapt.

Structured KM tooling also facilitates contextual reliability modeling—preserving not just data, but the reasoning and lived experience behind decisions. This depth supports post-mortem analyses, accelerates onboarding, and reinforces psychological safety, critical for experimentation and creative problem-solving. When embedded into governance structures such as Change Control Boards or steering

committees, KM ensures continuity, traceability, and shared mental models. Decision-support systems grounded in transparent knowledge access increase stakeholder trust and reduce cognitive load across roles.

As scaling demands faster pivots, KM becomes the compass guiding teams through complexity, enabling responsible risk-taking without sacrificing coherence. Furthermore, fostering a knowledge-sharing culture through inclusive storytelling, active listening, and open feedback loops amplifies the impact of OD efforts. From humble inquiry to cross-functional retrospectives, the social dimension of KM unlocks innovation that is emergent, co-created, and meaningful.

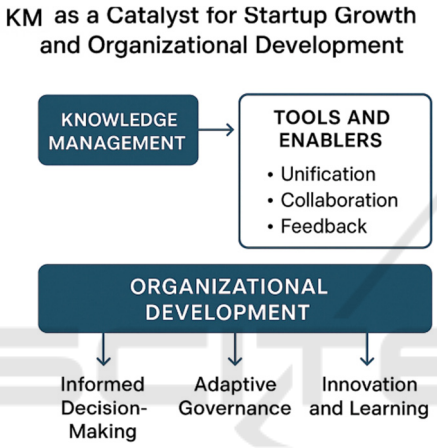

Figure 3: Strategic KM as Catalyst for Startup Growth.

4.2 Contribution and Limitations

This study advances scholarship at the intersection of knowledge management (KM), organizational development (OD), and startup growth by demonstrating how KM can be operationalized as a dynamic capability enabler in resource-constrained R&D environments. Despite these contributions, the study's findings should be interpreted considering some limitations. The dual role of practitioner-researcher inherent in action research introduces potential bias in data interpretation and intervention design, despite triangulation efforts across interviews, artifacts, and performance dashboards.

To build on this work, we propose avenues for scholarly inquiry. Mainly, this work sets the stage for multi-case comparative research across diverse startup sectors can illuminate boundary conditions for KM-embedded OD effectiveness and reveal potential industry-specific adaptations. Additionally, experimental or quasi-experimental designs could isolate the impact of KM strategy elements, such as governance forums versus repository structures, independent of technology platforms.

Nevertheless, our paper concretizes that by embedding strategic KM into capability transformation, startups could accelerate internal growth but also position themselves as learning organizations capable of driving ecosystem-wide change.

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