

Swiss Organ-on-Chip Landscape & Opportunities for Dutch-Swiss Collaboration

1. Management Summary

Switzerland possesses significant foundational strengths in the Organ-on-Chip (OoC) field, rooted in world-class microtechnology and precision engineering capabilities, and a globally recognized pharmaceutical hub in Basel. The ecosystem benefits from top-tier academic institutions, specialized research centers, and an agile startup culture. However, it faces challenges in coordination and scaling. The Netherlands presents a complementary ecosystem with structured national initiatives, established funding, and a focus on standardization and clinical translation.

The strategic combination of Swiss deep-tech, precision, quality, and pharma access with Dutch structured approaches, clinical validation power, standardization leadership, and scale-up infrastructure creates a uniquely potent synergy. This partnership is not merely additive but offers the potential for exponential growth, positioning a combined Dutch-Swiss effort for global leadership by accelerating innovation, setting new standards, and solving complex challenges in the OoC field.

Key recommendations for Dutch stakeholders include: prioritizing joint R&D projects targeting complex systems and specific disease areas; leveraging EU funding mechanisms; co-developing standardized validation protocols; engaging Swiss intermediaries; and fostering direct B2B engagement. Addressing the "Valley of Death" through joint funding initiatives is crucial. Strategic collaboration, focusing on these powerful complementary strengths, can overcome shared weaknesses and unlock significant potential.

2. Introduction

2.1. Aim and Scope

OoC technology, using biomimetic 3D systems to mimic human organ function, is revolutionizing biomedical research and drug development. It offers more physiologically relevant models than traditional methods, potentially reducing animal testing and accelerating the path to personalized medicine. Switzerland, with its strong life sciences sector, advanced microfabrication capabilities, and innovation focus, is a key player in this rapidly evolving field.

This report provides a comprehensive analysis of the Swiss OoC market and R&D landscape. It aims to:

- Map the Swiss OoC ecosystem, identifying key actors, their expertise, and networks.

- Analyze market drivers, trends, challenges, and opportunities within Switzerland.
- Identify strategic opportunities for collaboration between Dutch and Swiss stakeholders to leverage complementary strengths and achieve global market leadership in OoC technology.

3. Market Analysis: The Swiss Organ-on-Chip Ecosystem

Switzerland presents a dynamic and complex landscape for OoC technology. While possessing deep-seated strengths in relevant underlying technologies and hosting key global players in pharmaceuticals, the ecosystem's structure, funding realities, and cultural factors create a unique environment with both significant opportunities and notable challenges. This section dives into the current status, key actors, driving forces, and specific characteristics of the Swiss OoC field.

3.1. Status and Development of OoC in Switzerland

The foundation of Switzerland's OoC capability lies in its internationally renowned expertise in microtechnology and precision engineering, a legacy extending beyond watchmaking into medical devices and advanced manufacturing. This provides a fertile ground for the intricate microfabrication required for sophisticated OoC devices. Consequently, R&D activity in the OoC space is vibrant, characterized by a dynamic interplay between engineering disciplines, materials science, and advanced biology, primarily driven by leading academic institutions and a growing cohort of specialized startups.

However, despite this strong research base, the widespread commercialization and industrial adoption of OoC technologies within Switzerland appear to be in comparatively early stages. While established players exist in adjacent fields like 3D cell culture (e.g., InSphero with its focus on spheroids and microtissues), the number of mature, mid-sized Swiss companies with strong focus on OoC systems remains limited.

- **The Roles of Key Players:** The ecosystem is populated by distinct actors fulfilling different roles:
 - **Academic Institutions:** World-leading universities like ETH Zurich and EPFL, alongside other specialized institutions (e.g., FHNW, ZHAW), are the primary engines of fundamental research and innovation. They not only generate cutting-edge knowledge in microfluidics, bioengineering, and tissue modeling but also supply the highly skilled engineers and scientists crucial for the field's advancement. Their associated innovation parks also serve as incubators for new ventures.
 - **Startups:** A notable feature of the Swiss ecosystem is its collection of agile startups (such as Alveolix, Sun Bioscience, FluoSphera). These companies often emerge from academic discoveries and tend to focus on developing unique technological niches or providing highly customized solutions. Their proximity to potential clients, particularly in the Basel pharma

cluster, allows for a customer-centric approach, iterating designs based on direct feedback.

- **Established Companies:** Major pharmaceutical companies headquartered in Basel (notably Roche and Novartis) demonstrate growing interest in complex *in vitro* models, including OoC. They are investing in internal capabilities and exploring applications in drug discovery and preclinical safety assessment. However, their adoption is often cautious and fragmented across different departments, sometimes hampered by internal hurdles and skepticism regarding the immediate scalability, reproducibility, and cost-effectiveness of current OoC platforms compared to established methods. Technology providers (like 3Brain, Advanced Microfluidics, Hamilton, Tecan) offer essential tools and components, ranging from specialized measurement systems to industrial-scale fluidics and automation solutions. Of note are also companies in the nutrition space (Nestlé, dsm-firmenich) applying OoC models to human and animal nutrition.
- **Research Institutes & Centers:** Organizations like CSEM (Swiss Center for Electronics and Microtechnology) play a crucial facilitating role, acting as a trusted R&D partner to bridge the gap between academic invention and industrial application, particularly in microtechnologies. Others, like the 3R Competence Centre (3RCC), focus on promoting alternatives to animal testing and are actively mapping academic capabilities in advanced cell culture models, fostering networking within academia. Competence centers like TEDD (Tissue Engineering for Drug Development) at ZHAW also work to connect stakeholders.
- **Integration into Key Sectors:** The integration of OoC into routine use within Switzerland's healthcare, pharmaceutical, and biotech sectors is an ongoing process. While enthusiasm exists, particularly within pharma R&D departments exploring novel drug targets or mechanisms, the path to widespread adoption, especially for regulatory decision-making, remains long. Many companies view current OoC systems as promising research tools but await further maturation, standardization, and robust validation demonstrating clear advantages over existing models before incorporating them into critical development pipelines. The ultimate benchmark for many remains acceptance by major international regulators like the FDA and EMA.
- **Ecosystem Dynamics:** Collaboration within Switzerland frequently occurs organically, often on an ad-hoc, project-by-project basis driven by specific needs and existing relationships. Intermediaries like CSEM actively nurture these connections through workshops and tailored projects. However, a defining characteristic is the absence of a large-scale, top-down national strategy or a central coordinating body akin to initiatives seen in the Netherlands. This results in a fragmented landscape where individual initiative and competition are prized – seen by some as a strength fostering innovation and customer focus – but which others acknowledge hinders international visibility, strategic alignment, and the ability to tackle large-scale challenges like standardization

collectively. Furthermore, a discernible cultural trait of cautiousness or skepticism towards new technologies ("do we need this?") can sometimes temper the pace of adoption and cross-sector collaboration compared to other innovation hubs.

3.2. Key Players, Expertise, and Interactions

The Swiss OoC ecosystem comprises a diverse set of organizations contributing specialized knowledge and capabilities:

- **Areas of Expertise:**

- **Academic Powerhouses (ETH Zurich, EPFL, Universities like Basel, FHNW, ZHAW):** Globally recognized for excellence in engineering (microfabrication, microfluidics, sensor integration, materials science), bioengineering, computational modeling, and fundamental biology relevant to 3D cell culture and tissue engineering.
- **Key Research Institutes & Facilitators (CSEM, 3RCC, IHB):** CSEM offers deep expertise in applied microtechnologies and acts as a crucial R&D service provider and project facilitator. 3RCC champions the 3Rs and networks academic platforms. Institutes like IHB - while integrated in Roche - focus on translating human models (organoids) into pharma R&D workflows.
- **Innovative Startups:** Often possess deep expertise in specific organ models (e.g., Alveolix in lung/gut models), advanced cell culture techniques (e.g., InSphero with spheroids/MPS, Sun Bioscience with organoid technology), or novel platform designs (e.g., FluoSphera).
- **Pharmaceutical Giants (Roche, Novartis):** Possess extensive internal expertise in drug discovery pipelines, disease biology, safety assessment, and regulatory affairs. Their growing internal initiatives represent significant potential end-user demand and validation partnerships.
- **Technology & Service Providers:** Include specialists in measurement (3Brain's microelectrode arrays), industrial microfluidics and components (Advanced Microfluidics), laboratory automation (Hamilton, Tecan), and strategic/technical consultancy (Helbling).

- **Partnerships & Networking:**

- **Nature of Collaboration:** Partnerships are often bilateral and project-driven, connecting academia with industry or startups with specific pharma needs, frequently facilitated by CSEM or arising from personal networks. While effective for specific tasks, this ad-hoc nature limits broader strategic alignment.
- **Swiss-International Links:** Swiss researchers and companies actively participate in European framework programs like Horizon Europe and EUREKA/Eurostars, fostering international consortia. Attendance at major international conferences (MPS World Summit, EUROoCS) ensures

engagement with the global community. Bilateral ties exist, but systematic tracking or promotion is limited.

- **Networking Channels:** Key national events like Swiss Biotech Days offer broad visibility and partnering opportunities. More focused technical exchange occurs at CSEM workshops or TEDD meetings. Academic conferences and smaller, specialized meetings (e.g., 3D Basel) cater to specific niches but sometimes struggle to connect technology developers effectively with industrial end-users. Intermediary organizations like Euresearch (for EU funding), EEN Switzerland (for SME partnering), and SwissCore (Brussels liaison) play vital roles in facilitating international connections. Informal alliances like ClusterBoost also emerge from industry initiative.

- **Government Support & Funding:**

- **Funding Landscape:** The primary national funding agencies, Innosuisse and the Swiss National Science Foundation (SNSF), are crucial sources. Innosuisse typically supports collaborative projects between academia and industry but mandates a significant innovation component and often requires substantial industry co-funding or self-funding, potentially disadvantaging SMEs focused on validation or implementation rather than novel R&D. SNSF primarily funds academic research, including projects relevant to 3R and basic OoC science. However, Innosuisse's recent strategic orientations signal an increased emphasis on directly supporting the innovation capacity of companies, particularly SMEs. This includes initiatives such as the Swiss Accelerator and Start-up Innovation Projects (SIP), which allow for more direct funding and enable companies to take a leading role in R&D projects—even with relaxed requirements for academic involvement—provided they demonstrate strong innovation capabilities. While this strategic shift was initially driven by Switzerland's exclusion from European funding programs, it now appears to have enduring value even as Switzerland regains access to EU research initiatives. These mechanisms ease the path for SMEs to bring innovations closer to market, strengthen their global competitiveness, and position them as more attractive and capable partners for international collaboration.
- **Strategic Gaps:** A notable characteristic is the absence of large, government-directed, thematic funding programs specifically targeting OoC development, industrialization, and infrastructure build-up, in contrast to multi-million Euro initiatives observed in the Netherlands or France. Funding tends to follow a bottom-up approach, supporting investigator-initiated projects rather than a coordinated national strategy.
- **Subsidy Utilization:** While Switzerland generally fosters innovation through various mechanisms, the direct utilization of subsidies specifically for OoC scale-up and commercialization by SMEs appears limited, partly due to the structure of available funding which favors academic-led or highly novel projects. Access to later-stage growth capital (Series A/B)

remains a widely acknowledged bottleneck for startups aiming to scale. Engagement with Venture Capital (VC) firms is crucial for navigating this 'Valley of Death,' yet their perception of OoC opportunities is nuanced. While VCs recognize the transformative potential in drug development and personalized medicine, they often remain cautious due to the long development and validation timelines, uncertain regulatory pathways for novel OoC applications, and questions around the scalability of business models (e.g., service-based vs. product sales). Many VCs seek de-risked assets with clear market traction or strong validation data. However, specialized biotech VCs, or those with a longer-term view, can play a vital role by providing not only capital but also strategic guidance, access to industry networks, and expertise in building life science companies. Facilitating interactions between promising OoC ventures (both Swiss and Dutch) and knowledgeable VCs, potentially through curated investor forums or by showcasing successful validation milestones, is essential. Joint NL-CH initiatives could also explore co-investment funds or mechanisms to attract VC interest by mitigating early-stage risks.

3.3. Market Drivers and Trends

Several converging factors are shaping the trajectory of the OoC market in Switzerland and globally:

- **Key Technological Advancements:**

- **Maturing Microphysiological Systems (MPS):** Continuous improvements in chip design, microfluidic control, and material science, leveraging Switzerland's engineering base.
- **Sophisticated 3D Cell Models:** Rapid progress in generating and utilizing organoids, spheroids, and other complex microtissues that better mimic human physiology.
- **Need for Automation & Throughput:** A critical bottleneck for broader adoption, especially in drug screening, driving demand for automated platforms and higher-throughput systems.
- **AI and Predictive Modeling:** Growing interest in leveraging the rich datasets from OoC platforms with AI/machine learning for more accurate predictions of drug efficacy and toxicity.
- **Focus on Assays & Endpoints:** Recognition that sophisticated models must be paired with robust, quantitative, and functionally relevant assays to generate meaningful data.
- **Rise of Reverse Translation:** Increasing emphasis on validating *in vitro* models using human clinical data and patient samples, rather than solely relying on animal model correlations, to improve predictive accuracy.
- **Advanced Materials & Manufacturing:** Moving beyond PDMS towards materials suitable for scalable manufacturing (e.g., injection molding) and specific biological needs.

- **Multi-Omics Integration:** Incorporating genomics, transcriptomics, proteomics, and metabolomics data from OoC systems for deeper biological insights.

- **Global Competition**

- **Beyond Europe:** The growth of the OoC market is also intensified by robust global competition, with significant innovation and investment activities not only across Europe but also emanating from strong research and commercial hubs in North America and Asia, such as for example China setting its first national standards for “organ-on-a-chip technology”. This dynamic worldwide landscape underscores the pressure for continuous advancement and strategic positioning.

- **Swiss Differentiators:**

- **Core Strengths:** The deep-rooted culture of precision engineering and available microtechnology expertise provides a significant competitive advantage. The agility and customer-focus of many Swiss startups allow for rapid adaptation. The internationally respected "Swiss label" enhances credibility and trust. Close geographical proximity to Basel's pharma giants facilitates communication and collaboration. Easy company formation processes support entrepreneurship.
- **Acknowledged Weaknesses:** Ecosystem fragmentation hinders coordinated efforts and international visibility. Cultural skepticism can slow adoption. Funding limitations, particularly for scaling SMEs, pose a major barrier. Validation and standardization remain underdeveloped. Complex ethical approval processes for human cells (hES, hiPSC, donor-derived stem cells or tissues) add hurdles.

- **Regulatory Landscape & Comparisons:**

- **Swiss Context (Swissmedic):** While respected for quality, Swissmedic regulates a relatively small market. Consequently, OoC developers focused on global impact prioritize meeting the requirements of larger agencies like the US Food and Drug Administration (FDA) and the European Medicines Agency (EMA). There isn't a specific, dedicated regulatory pathway for OoC devices themselves in Switzerland; their assessment depends heavily on the intended use (e.g., research tool vs. diagnostic vs. basis for clinical decisions). Navigating the cantonal system for ethical approvals related to human cells and tissues can be time-consuming and complex, potentially making Switzerland less attractive for certain types of research compared to regions with more streamlined processes (e.g., specific US states, Germany).
- **International Context (NL/EU/FDA):** The Netherlands is proactively engaged in standardization discussions (via NEN) and integrating OoC into national health strategies. The FDA Modernization Act 2.0 in the US signals growing openness to alternatives to animal testing, although clear

regulatory pathways for OoC are still evolving. The focus may shift towards validating the *data* generated by OoC systems or certifying the labs performing the assays (e.g., CLIA in the US for diagnostics) rather than approving the device itself, offering potential routes for service-based models. Harmonization across regions remains a long-term goal. A significant factor impacting potential Swiss-EU collaboration in regulated medical technologies, including OoC systems aspiring to diagnostic or clinical applications, is the non-renewal of the Mutual Recognition Agreement (MRA) between Switzerland and the EU concerning medical devices. This effectively treats each party as a 'third country,' potentially increasing regulatory hurdles, costs, and timelines for market access of co-developed devices that fall under medical device regulations. While OoC systems intended purely for research use may be less directly affected, this regulatory divergence is a key consideration for collaborations aiming at clinical translation or diagnostic applications.

- **Potential NL-CH Synergies: A Foundation for Exponential Growth**

The collaboration between the Netherlands and Switzerland in the OoC field is not merely advantageous; it represents a strategic imperative capable of unlocking exponential growth and establishing global leadership. What makes this partnership uniquely potent and "special" is the profound synergy between their distinct yet perfectly complementary strengths – a combination difficult to replicate elsewhere:

- **The Swiss Innovation Engine:** Switzerland brings to the table world-renowned expertise in microtechnology, precision engineering, and high-quality manufacturing, essential for creating sophisticated and reliable OoC hardware. This is augmented by a dense network of globally leading academic institutions (ETH Zurich, EPFL), an agile startup culture adept at developing customer-centric solutions, direct access to and insights from the major pharmaceutical companies headquartered in Basel, and the globally respected "Swiss label" signifying quality and trust.
- **The Dutch Ecosystem for Translation and Scale-Up:** The Netherlands contributes a robust, nationally coordinated approach to innovation (e.g., Health Holland, HDMT), established infrastructure and funding mechanisms supporting clinical validation and technology scale-up, strong leadership in developing and implementing standardization frameworks (e.g., through NEN), and deep expertise in specific biological models (including advanced organoid technology) and their application in disease research.

This unique fusion of Swiss deep-tech innovation with Dutch translational power can drive exponential growth by:

1. **Accelerating Time-to-Market:** Swiss-developed advanced OoC platforms can be rapidly validated and refined using Dutch clinical networks, patient-derived materials, and established validation pathways. This

significantly shortens the journey from lab prototype to market-ready, clinically relevant solutions.

- *Example:* A Swiss startup with a novel microfluidic lung-on-chip platform could partner with a Dutch clinical center specializing in cystic fibrosis, leveraging HDMT networks, to rapidly validate the model with patient-derived cells, leading to a best-in-class solution for CF drug testing much faster than either could achieve alone.
2. **Setting Global Standards:** By combining Swiss precision in assay development and device manufacturing with Dutch leadership in framework development and clinical validation, a joint NL-CH effort can proactively define and champion functional standards for OoC systems. These jointly developed and validated platforms are more likely to gain international acceptance and become global benchmarks.
 3. **Attracting Greater Investment:** A larger, more coordinated, and highly synergistic NL-CH OoC bloc presents a far more compelling proposition to international venture capital and strategic corporate investors than two smaller, separate ecosystems. Demonstrated successes from joint initiatives will further de-risk investment in the sector.
 4. **Solving Bigger, More Complex Problems:** The combined intellectual capital, technological capabilities, and biological expertise will enable the partnership to tackle highly complex scientific and medical challenges, such as developing integrated multi-organ systems for studying systemic drug responses or creating advanced immune-competent OoC models for oncology or autoimmune diseases, which are often beyond the scope of individual national efforts.
 - *Example:* Swiss expertise in high-precision sensor integration and microfabrication combined with Dutch advanced organoid technology and clinical data access could create sophisticated "smart" OoC systems providing real-time functional readouts for predictive toxicology or efficacy testing, a solution highly sought after by the pharmaceutical industry.
 5. **Creating and Accessing New Markets:** Offering highly validated, reliable, and standardized OoC solutions can unlock new applications and markets in pharmaceuticals (beyond early discovery), as well as in chemicals, cosmetics, nutrition, and personalized medicine, sectors that are currently underserved by existing preclinical models.

The existing, albeit sometimes informal, collaborations, such as the industry-driven **ClusterBoost initiative** which includes Dutch company MIMETAS alongside Swiss leaders, already signal an organic recognition of this synergistic potential. By formalizing and strategically expanding such interactions, the NL-CH partnership can move beyond incremental advances to achieve transformative impact in the global OoC landscape. This collaboration offers a clear pathway to overcome key weaknesses inherent in each ecosystem operating alone—Swiss fragmentation and the "Valley of Death" for scaling, and the Dutch need for continuous cutting-edge technological input—thereby strengthening the entire innovation pipeline from discovery to market.

4. Market Entry, Challenges, and Opportunities (Dutch-Swiss Perspective)

4.1. Challenges Facing Swiss Players and Potential Dutch-Swiss Collaborations

While both Switzerland and the Netherlands possess strong OoC ecosystems, several challenges hinder progress within Switzerland and could impact potential collaborations. These represent the combined weaknesses and threats when considering a joint Dutch-Swiss strategy.

- **Fragmentation and Lack of Coordination (Weakness):** Unlike the Netherlands' more structured approach with initiatives like HDMT coordinating efforts, the Swiss landscape operates with "almost no structure," often feeling like "everybody's just for themselves." This lack of a central coordinating body or large-scale national strategy makes it difficult to gain international visibility, align priorities, and efficiently leverage resources. This fragmentation extends to numerous small, niche conferences that struggle to bridge the gap between developers and industry end-users.
- **The "Valley of Death" and Funding Gaps (Weakness):** Swiss startups face a significant hurdle in securing growth capital (Series A/B) needed to scale beyond initial R&D. While seed funding and academic grants (like SNSF) are available, mechanisms like Innosuisse often require academic partners and focus on novel innovation rather than implementation or scaling. There's a lack of large, dedicated national funding programs for OoC commercialization comparable to those seen in the Netherlands. This absence of robust national support can slow startups' progress and make it challenging for them to secure partnerships with venture capitalists seeking scalable opportunities, often compelling these companies to rely on organic growth, European grants, or the arduous search for venture capital abroad. The difficulty in traversing this 'Valley of Death' is further compounded by the specific nature of VC engagement with the Organ-on-Chip sector. While VC investment is critical for scaling and commercialization, many VCs exhibit caution towards OoC ventures. This reluctance often stems from the perceived high risks associated with long R&D and validation timelines, uncertainties surrounding regulatory pathways for novel OoC applications, and questions about the scalability and profitability of various business models (e.g., service-based versus product sales). VCs typically seek de-risked opportunities with clear market traction or substantial validation data, criteria that early-stage OoC companies may struggle to meet. As a result, without proactive strategies to engage specialized life science VCs or initiatives to mitigate early-stage investment risks, the funding gap for promising OoC startups aiming to scale their operations persists as a significant challenge.
- **Standardization and Validation Hurdles (Weakness):** The tendency towards bespoke, customer-specific solutions, while fostering agility, hinders the development of standardized, validated OoC systems needed for broad industrial and regulatory acceptance. This contrasts with growing international

efforts (including in the Netherlands) to establish functional benchmarks and validation frameworks. The lack of agreed-upon standards complicates data comparison and regulatory qualification.

- **Bridging Gaps: Academia, Industry, and Clinics (Weakness):** Significant gaps persist between academic research, startup innovation, large corporate adoption (especially cautious pharma), and clinical application. Engaging university hospitals is difficult due to funding constraints, competing priorities, and complex, slow ethical approval processes for human-derived materials (hindered by cantonal regulations). This slows down crucial "reverse translation" efforts needed for validation.
- **Cultural Factors (Weakness/Threat):** A pervasive cultural skepticism ("do we need this?") can slow the adoption of new technologies like OoC. Furthermore, the Swiss preference for bottom-up initiatives might clash with more structured, top-down Dutch programs, potentially creating friction in joint ventures.
- **Operational & Structural Challenges (Weakness/Threat):** The high cost of doing business in Switzerland (e.g., for GMP facilities) can be a barrier. For Dutch companies, navigating the fragmented ecosystem without a clear counterpart organization like Health Holland presents a challenge. Failed past attempts at joint funding calls (e.g., Innosuisse-Health Holland 2024 on cell therapies) highlight difficulties in aligning cross-border priorities. Lessons from such experiences suggest potential challenges in harmonizing disparate national strategic interests within a specific call topic, reconciling different funding agency regulations and timelines, ensuring evaluation criteria are mutually agreeable, or overcoming administrative complexities inherent in cross-border initiatives. Future joint funding efforts must proactively address these potential pitfalls through thorough preparatory work, clear communication between agencies, and a focus on areas with undeniable mutual strategic benefit and compatible funding mechanisms."
- **External Threats:** The ambitions of a Dutch-Swiss OoC collaboration face considerable external pressures:
 - **Intensified Global Competition:** The Netherlands and Europe face increasing competition from other well-funded and strategically coordinated international hubs. The United States remains a key competitor, backed by large-scale federal programs (e.g., NIH, BARDA), a historically strong venture capital ecosystem, a large unified market, historically more streamlined FDA pathways for novel technologies, and a concentration of leading research institutions and companies. While recent political developments have, in some instances, been perceived as making the U.S. less attractive to international researchers and entrepreneurs—potentially weakening its traditional dominance in drawing global talent and creating an opportunity for Europe—U.S. policies also increasingly prioritize domestic innovation and manufacturing. This could shape global IP strategies and standard-setting in ways that might disadvantage European stakeholders. Beyond the US, notable competition also comes from the United Kingdom, France, Germany, and rapidly advancing OoC programs in Asian countries (e.g. China starting national standards initiative for OoC). This global landscape

creates a strong pull for talent and investment, which could divert resources from European initiatives. These trends underscore the strategic importance of establishing a coordinated and competitive European position, to which a robust NL-CH partnership could significantly contribute.

- **Collaboration Complexities and IP Risks:** While collaboration is key, multi-partner international consortia carry inherent risks. These include potential misalignment of strategic national priorities leading to divergent project goals, inefficiencies in resource allocation across borders, and an uneven distribution of benefits. Crucially, without meticulously crafted upfront agreements and proactive, careful management, there is a tangible risk of intellectual property (IP) leakage or disputes over IP ownership and exploitation rights, particularly in fast-moving research areas.
 - **Regulatory and Market Access Divergence:** Differing regulatory frameworks can create significant hurdles for co-developed products aiming for clinical or diagnostic use, thereby increasing time-to-market and costs. The non-renewal of the Swiss-EU Mutual Recognition Agreement (MRA) for medical devices serves as a prominent example of such challenges, impacting seamless market access.
 - **Economic and Geopolitical Instabilities:** Broader geopolitical shifts, trade policies, or economic downturns could also adversely impact international collaboration, the availability of public and private funding, and the stability of supply chains for critical components or reagents necessary for OoC development and application.
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- **Bridging the 'Valley of Death': A Transnational Challenge Requiring Collaborative Solutions** The 'Valley of Death' – the critical funding and resource gap between early-stage research and commercially viable products – is a pervasive issue in both the Swiss and Dutch OoC ecosystems, albeit with different nuances. While Switzerland excels in invention, translating these into scaled innovations is hampered by limited later-stage national funding for SMEs. The Netherlands, while having more structured scale-up support, can benefit from Swiss technological ingenuity.

Strategies to bridge this gap through NL-CH collaboration could include:

- **Targeted Joint Funding Initiatives:** Beyond general EU calls, exploring bilateral funding mechanisms or public-private partnerships specifically designed to co-fund NL-CH ventures through the validation and early commercialization phases. This could involve matched funding or programs supporting joint SME-led projects focused on product development and market entry.
- **Leveraging Dutch Scale-Up Infrastructure for Swiss Innovation:** Facilitating partnerships where promising Swiss OoC technologies are scaled, validated, and potentially manufactured using Dutch infrastructure, expertise (e.g., via HDMT, Demcon), and clinical networks.

- **De-risking for Venture Capital:** Jointly showcasing validated technologies and successful cross-border pilot projects to attract both domestic and international VCs. Creating co-investment opportunities or government-backed VC funds focused on NL-CH OoC ventures could also be explored.
- **Shared Validation Platforms and Resources:** Establishing access to shared, high-cost infrastructure (e.g., GMP-like facilities, advanced imaging) or jointly developing standardized validation protocols and services could lower the cost and time barrier for startups in both countries to achieve robust validation, making them more attractive for investment.

4.2. Opportunities for Dutch-Swiss Collaboration

Despite the challenges, the combined strengths of the Dutch and Swiss ecosystems create significant opportunities for synergistic collaboration, aiming for global leadership in the OoC field. These opportunities are magnified when viewed through the lens of the unique NL-CH synergy, where Swiss technological depth meets Dutch translational and scaling prowess:

- **Leveraging Complementary Strengths (Strength):** This is the core opportunity. The fusion of Swiss world-class microtechnology and precision engineering with Dutch structured programs, clinical validation networks, and standardization expertise forms a powerful, self-reinforcing innovation cycle.
- **Joint R&D and Innovation (Opportunity):** Collaborate on next-generation OoC systems and disease-specific platforms, knowing that Swiss engineering breakthroughs can be rapidly advanced through Dutch biological and clinical application pipelines.
- **Driving Standardization and Validation (Opportunity):** Jointly tackle the critical need for robust validation, combining Swiss precision in assay development with Dutch leadership in establishing functional benchmarks recognized by regulators.
- **Creating a Stronger European Hub (Opportunity):** A strategic NL-CH alliance, built on this powerful synergistic foundation, can form a leading European pole, enhancing competitiveness against other global centers.
- **Enhanced Market Access and Business Development (Opportunity):** Collaboration can facilitate market entry, with the combined offering of Swiss quality and Dutch validated utility strengthening their collective position.
- **Accessing Broader Funding Pools (Opportunity):** Jointly pursue larger EU grants, presenting a more compelling and comprehensive value proposition to funders due to the integrated strengths.
- **Shared Infrastructure and Scale-up (Opportunity):** Explore shared access to infrastructure or joint development platforms, where Swiss tech innovators can benefit from Dutch experience in scaling production.
- **Addressing Societal Needs (Opportunity):** Capitalize on the societal push to reduce animal testing by jointly advancing validated OoC alternatives,

showcasing a complete pathway from Swiss-engineered devices to Dutch-validated applications.

- **Building on Existing Connections (Strength):** Utilize existing links as foundations for deeper collaboration, amplified by a clear understanding of the exponential potential of their combined capabilities.

By strategically addressing the weaknesses and threats while capitalizing on the combined strengths and these synergistic opportunities, a Dutch-Swiss partnership can significantly accelerate progress and establish a dominant position in the rapidly growing global Organ-on-Chip market.

5. Building Strategic Collaborations: Enabling Communication and Partnership

Forging a successful and sustainable Dutch-Swiss partnership in the complex Organ-on-Chip landscape requires more than just recognizing complementary strengths; it demands proactive efforts to foster communication, connect the right stakeholders, and structure joint activities effectively. Several platforms, intermediaries, and collaborative models can be leveraged to build these crucial bridges between the two ecosystems.

5.1. Platforms and Intermediaries for Enabling Connection

A variety of channels exist to facilitate interaction and matchmaking between Dutch and Swiss players:

- **Key Events as Interaction Hubs:**
 - **Strategic Partnering & Visibility:** The annual **Swiss Biotech Days** stands out as a major international event in Basel, offering high visibility and strategic partnering opportunities. Health Holland's participation, including organizing dedicated OoC panels, underscores its value as a prime venue for initiating Dutch-Swiss dialogue and collaborations. Larger events like **BioEurope** also serve as scouting grounds for external innovation teams from pharma seeking new technologies.
 - **Scientific & Technical Exchange:** International conferences like the **MPS World Summit** and **EUROoCS** (European Organ-on-Chip Society), often held jointly, are essential for deep scientific exchange, showcasing cutting-edge research, and networking within the global expert community. The Netherlands holds a strong administrative position within EUROoCS. National or regional events like the **TEDD Annual Meeting** in Switzerland cater specifically to the tissue engineering community.
 - **Focused Matchmaking:** Workshops organized by intermediaries like **CSCM** in Switzerland have proven highly effective in bringing together specific academic groups, startups, and industry players for targeted technical discussions and project initiation. These offer valuable opportunities to introduce Dutch initiatives to relevant Swiss innovators.

- **Technology & Supplier Connections:** Events like **ILMAC** in Switzerland provide a platform to connect with suppliers of essential enabling technologies, such as imaging systems, plate readers, and automation equipment.
- **Niche Gatherings:** While smaller conferences like 3D Basel or Organ Meet Zurich exist, their fragmented nature can sometimes limit broad impact, highlighting the need for strategic engagement at larger, more cross-disciplinary events.

- **Networks and Collaborative Initiatives:**

- **Digital Contact Points:** General professional networks like **LinkedIn** are commonly used for initial contact identification. More structured national networks, such as the **HDMT (Institute for Human Organ and Disease Model Technologies)** in the Netherlands, operate as virtual institutes, connecting researchers across institutions through regular meetings and conferences, fostering a cohesive internal community. In Switzerland, the **3R Competence Centre** is working towards creating a similar network, initially focused on academic platforms offering advanced cell culture technologies.
- **Industry-Led Alliances:** Bottom-up initiatives like **ClusterBoost**, an informal alliance of leading Swiss OoC companies (including InSphero, Alveolix) alongside Dutch company MIMETAS, exemplify industry efforts to amplify visibility and explore joint projects, reflecting Switzerland's collaborative culture, albeit often outside formal structures.
- **Proposed Enhancements:** Ideas such as a centralized "technology stock exchange," potentially modeled on initiatives like IQMPS in the US (or Scientist.com), have been proposed to create a more efficient mechanism for pre-vetted startups to pitch solutions aligned with specific industry needs (e.g., pharma requirements), streamlining the matchmaking process.

- **The Crucial Role of Intermediaries:**

Several organizations act as vital connectors and facilitators:

- **National Trade & Network Organizations:** The **Swiss Biotech Association** serves as a key national voice and organizes the aforementioned Swiss Biotech Days. **Swiss BiotechNet** specifically focuses on bridging academic research and early-stage startups. Organizations like **Toolpoint** connect professionals in the fluid handling space. In the Netherlands, organizations associated with past **Health Holland** initiatives and the current **HDMT** play central roles in coordinating the Dutch ecosystem. While **Medtech Switzerland** exists, its focus tends to be more on traditional medical devices and automation rather than the core biological aspects of OoC.
- **Facilitators for International Collaboration:** **Euresearch** in Switzerland provides invaluable expertise and support for navigating EU funding

programs like Horizon Europe and Eurostars, actively encouraging and assisting in the formation of Dutch-Swiss consortia. The **Enterprise Europe Network (EEN) Switzerland**, part of Innosuisse, offers practical matchmaking services, connecting Swiss SMEs with international partners, including those in the Netherlands, particularly within the health sector. **SwissCore**, the Swiss liaison office in Brussels, provides neutral ground and support for developing collaborative projects within the European context. These organizations are instrumental in translating interest into concrete joint applications and projects.

5.2. Defining a Shared Value Proposition and Structuring Collaboration

Beyond simply connecting people, building successful partnerships requires defining a compelling shared vision and structuring joint activities strategically:

- **Building a Shared Value Proposition:** The ultimate goal of Dutch-Swiss collaboration should be to leverage the unique combination of strengths – Swiss precision engineering, microfabrication mastery, pharma proximity, and quality focus, combined with Dutch coordination, clinical translation expertise, standardization leadership, and scale-up capabilities – to offer superior OoC solutions to the global market. This could manifest as highly validated, disease-relevant platforms developed faster, more reliably, or with unique functionalities compared to competitors.
- **Prioritizing Valuable Joint Activities:** Based on the ecosystem analysis, certain collaborative activities hold particular promise:
 - **Co-development and Validation:** This emerges as a critical priority. Joint projects focused on rigorously validating OoC systems against relevant biological benchmarks and regulatory expectations can address a major industry bottleneck and build credibility. Combining Swiss technological platforms with Dutch clinical networks and validation frameworks is key.
 - **Joint Research on Frontier Topics:** Collaborations can target fundamental scientific challenges or explore next-generation OoC technologies (e.g., integrating advanced sensors, developing complex multi-organ interactions, leveraging AI), pooling intellectual resources from leading academic groups in both countries.
 - **Shared Infrastructure and Platforms:** Pilot projects exploring shared access to expensive, specialized equipment (e.g., high-content imaging, GMP-like environments for clinical translation) or co-developing standardized testing platforms could enhance efficiency and reduce costs for players in both ecosystems.
 - **Targeted Joint Funding Applications:** Strategically forming consortia to apply for significant EU grants (Horizon Europe, EUREKA/Eurostars) provides a concrete mechanism to fund ambitious collaborative research, development, and innovation projects.

By actively utilizing these platforms and intermediaries, defining a clear joint value proposition, and focusing on high-impact collaborative activities, Dutch and Swiss stakeholders can build sustainable relationships that accelerate innovation and strengthen their collective position in the global Organ-on-Chip field.

6. Conclusions and Recommendations

6.1. Conclusions: The Strategic Imperative for Dutch-Swiss Collaboration

The Strategic Imperative for Dutch-Swiss Collaboration The analysis reveals Switzerland as a nation possessing formidable assets in the Organ-on-Chip domain, rooted in its precision engineering and microtechnology. However, this potential is constrained by fragmentation and scaling challenges. The Netherlands offers a complementary profile with structured initiatives and translational strengths.

Therefore, a strategic collaboration between the Dutch and Swiss OoC ecosystems is not merely advantageous; it represents a compelling strategic imperative. The unique synergy—marrying Switzerland's deep technological innovation, engineering prowess, and pharma proximity with the Netherlands' structured approach, clinical validation expertise, standardization leadership, and scale-up infrastructure—is the cornerstone of this imperative. This powerful combination is what makes the collaboration truly special and capable of more than additive gains. By directly addressing the critical weaknesses inherent in each system operating alone, such an alliance has the potential to create a synergistic powerhouse. This can overcome shared hurdles like validation and market access, accelerate the development of impactful OoC solutions, and achieve a dominant, potentially exponential, growth trajectory in the competitive global market. Realizing this potential, however, requires deliberate action, mutual understanding of differing ecosystem dynamics, and a commitment to building effective bridges through targeted initiatives.

6.2. Strategic Recommendations for Dutch Stakeholders

Based on the comprehensive analysis of the Swiss landscape and the powerful potential synergies with the Netherlands outlined above, the following strategic recommendations are proposed for Dutch companies and organizations aiming to foster collaboration and achieve global leadership in the OoC market (as of May 2025):

1. Establish a Dedicated NL-CH OoC Collaboration Task Force

Who: Interested and representative OoC industry players (SMEs, startups, large enterprises), leading academic institutions and research consortia (e.g., HDMT, CSEM, universities), and relevant governmental and innovation agencies from both countries (acting in a supportive and enabling capacity).

What: Initiate the establishment of a joint NL-CH OoC Collaboration Platform within 3-6 months. This Platform will aim to:

- Champion and facilitate collaborative initiatives emerging from this report and identified by the stakeholders.
- Act as a primary liaison and communication hub for the Dutch-Swiss OoC communities.
- Support the sharing of progress and outcomes from joint activities (e.g., through periodic updates or stakeholder meetings).
- Convene stakeholders to periodically explore new collaborative opportunities and strategic alignments.

How: The Platform should be launched with a joint exploratory workshop involving key stakeholders from academia, industry, and government from both countries to co-define its mission, operational structure, and priorities. It should operate in a lightweight and flexible manner, focused on creating value and facilitating connections rather than imposing directives. A non-binding Memorandum of Understanding (MoU) between core participating organizations could formalize shared goals and collaborative principles. Coordination could be handled by a small, rotating steering group with strong research and industry representation, supported by relevant agencies. Emphasis should be on minimal bureaucracy, leveraging existing networks, and connecting initiatives to appropriate funding sources rather than managing funds directly.

Why: To provide a community-driven framework for sustained collaboration, ensure transparency and shared momentum for joint initiatives, and create a recognized central point of connection and facilitation for all stakeholders, thereby helping to overcome fragmentation and foster a cohesive joint strategy through bottom-up engagement and voluntary alignment.

2. Systematically Pursue and Enhance Joint EU Funding Success

Who: The NL-CH OoC Collaboration Task Force, Dutch (e.g., RVO, ZonMw) and Swiss (e.g., Euresearch, Innosuisse, SNSF) funding agencies/national contact points (NCPs), research institutions, and SMEs from both countries.

What: Develop and implement a joint strategy by end of 2025 aimed at significantly increasing the success rate and volume of NL-CH participation in relevant EU funding programs (e.g., Horizon Europe, EUREKA/Eurostars, Innovative Health Initiative - IHI). Set a tangible target, such as a 25% increase in jointly funded projects within the next three years. Prioritize calls supporting focused, shorter-term proof-of-concept projects (12-24 months) that bridge academic innovation with specific pharmaceutical or industrial needs.

How: The Task Force to establish a joint "EU Funding Support Group" leveraging expertise from RVO and Euresearch. This group will proactively identify relevant EU calls, organize joint proposal-writing workshops, offer matchmaking services, and potentially provide seed grants for consortium building and proposal preparation for high-potential NL-CH teams.

Why: To secure substantial non-dilutive funding for ambitious collaborative R&D and innovation, utilize established European frameworks to de-risk pioneering projects, and elevate the international competitiveness and visibility of the combined NL-CH OoC ecosystem.

3. Focus Collaborative Efforts on High-Synergy Application Areas

Who: The NL-CH OoC Collaboration Task Force, in close consultation with national funding agencies, key research institutes (e.g., HDMT, CSEM, university medical centers), and industry/academic experts from both nations.

What: Within 12-18 months, formally identify, define, and publish a joint list of 3-5 high-synergy application areas or specific disease models (e.g., immuno-oncology, complex neurodegenerative disorders, multi-organ toxicity platforms) where the combined NL-CH capabilities offer a distinct and sustainable global competitive advantage. Develop high-level joint strategic roadmaps for these prioritized areas, outlining key research questions, technological needs, and validation goals.

How: Through a series of structured, expert-led workshops (minimum of two, one hosted in NL, one in CH) designed to meticulously map complementary technological and biological expertise, clinical access, data resources, and industrial interests. The Task Force will commission a joint working group to synthesize workshop findings and draft the strategic roadmaps for public consultation and finalization.

Why: To strategically concentrate collaborative resources and intellectual capital on areas of maximum potential impact, leverage unique complementary strengths most effectively, and accelerate the development and delivery of world-leading OoC solutions that address significant unmet medical or industrial needs.

4. Co-Develop and Implement Solutions for the "Valley of Death"

Who: The NL-CH OoC Collaboration Task Force, national and regional funding/development agencies (e.g., Innosuisse, RVO, Oost NL, cantonal economic development offices), public and private investment funds, and venture capital firms specializing in life sciences and deep tech in both countries.

What: By mid-2026, investigate, design, and launch at least one pilot bilateral financial instrument or support program specifically aimed at enabling NL-CH OoC ventures to navigate the critical post-R&D, pre-commercialization "Valley of Death." This instrument should aim to provide targeted financial support (e.g., in the range of €200k - €2m per project, subject to feasibility study) for 3-5 high-potential joint projects or ventures annually, focusing on validation, scaling, and market preparation.

How: The Task Force to commission a feasibility study (to be completed within 9 months) on potential models, such as: a joint NL-CH OoC accelerator program

with integrated seed funding; matched funding schemes between Dutch and Swiss agencies for pre-commercial OoC innovations; a co-investment fund or joint seed fund leveraging public and private capital; or a dedicated grant scheme for joint late-stage validation, GMP-scaling, and market entry strategy development. Actively engage with VCs and angel investor networks to co-design initiatives that de-risk investments in this crucial phase.

Why: To directly address the critical funding and resource gap that often stalls the translation of promising Swiss and Dutch OoC innovations into market-ready, impactful products, thereby unlocking significant economic potential and strengthening the entire innovation pipeline from lab to market.

5. Drive Pragmatic Alignment on Regulatory and Ethical Frameworks

Who: The NL-CH OoC Collaboration Task Force, by establishing a dedicated "Regulatory & Ethics Harmonization Working Group" including representatives from industry (SMEs and large pharma), academic ethics committees, data protection officers, patient advocacy groups, and liaisons with national regulatory bodies (e.g., Swissmedic, Dutch CBG-MEB, relevant authorities for New Approach Methodologies - NAMs).

What: By end of 2026, deliver a joint white paper that identifies the top 3-5 regulatory and ethical bottlenecks hindering efficient NL-CH OoC research, development, and data sharing (especially concerning human material use, cross-border data transfer under GDPR/Swiss DPA, and pathways for NAM acceptance). Propose concrete, actionable pilot initiatives for at least two of these bottlenecks – for example, developing a template for expedited, reciprocal ethical review for collaborative OoC studies using human-derived cells, or establishing mutually recognized data standards and security protocols for preclinical OoC data packages intended for shared analysis. *

How: The working group will conduct a comparative analysis of relevant Dutch and Swiss regulations, guidelines, and best practices. It will consult with national experts and identify areas where pragmatic alignment is feasible without requiring major legislative changes. Pilot initiatives will be designed for specific, well-defined collaborative projects to test and refine proposed solutions.

Why: To significantly reduce administrative friction, shorten timelines for cross-border research involving human-derived materials or sensitive data, and enhance the attractiveness and efficiency of NL-CH collaborations aiming for translational impact or regulatory consideration of OoC-derived data.

6. Champion and Co-Lead the Development of Functional OoC Standards

Who: The NL-CH OoC Collaboration Task Force, mobilizing key academic groups (e.g., from ETH Zurich, EPFL, Dutch universities via HDMT), industry leaders (OoC developers, pharma end-users) from both countries, and actively engaging with national (e.g., NEN in NL, SNV in CH) and international standardization bodies (e.g., ISO, CEN, OECD) and relevant scientific societies (e.g., EUROoCS).

What: Initiate and provide seed funding for at least two joint NL-CH working groups by mid-2026. These groups will be tasked with drafting best-practice guidelines and functional standard proposals for well-defined OoC applications (e.g., a liver steatosis model for drug-induced liver injury assessment; a blood-brain barrier model for evaluating drug permeability). The focus will be on performance criteria, validation methodologies, standardized readouts, and data reporting standards, rather than overly prescriptive technical chip specifications.

How: Organize consensus-building workshops with a broad range of stakeholders. Conduct joint round-robin studies across Dutch and Swiss laboratories to establish the reproducibility and robustness of proposed functional assays and endpoints, leveraging Swiss precision measurement capabilities with Dutch clinical and biological validation expertise. Actively submit developed guidelines and standard proposals to relevant national and international standardization bodies for broader adoption.

Why: To bolster the credibility, reproducibility, and comparability of OoC-generated data from both ecosystems, thereby increasing trust in these advanced technologies and facilitating their broader adoption by pharmaceutical and other industries, as well as their acceptance by regulatory agencies as part of a weight-of-evidence approach.

7. Prioritize Joint Validation Efforts in Disease Areas with Rich Clinical Data Access

Who: The NL-CH OoC Collaboration Task Force, clinical research centers, university hospitals (e.g., members of HDMT in NL, Swiss university hospitals like CHUV, Inselspital, USZ), patient organizations, and biobanks in both countries.

What: Collaboratively identify and promote 2-3 specific disease areas (e.g., prevalent cancers with established molecular subtypes, metabolic diseases with large patient cohorts and available longitudinal data, or rare genetic diseases with well-characterized patient-derived iPSC lines) where both countries possess strong clinical research capabilities and robust, ethically sourced access to high-quality patient data and biological samples. Launch at least one flagship joint "reverse translation" project in a prioritized disease area by the end of 2026, aimed at qualifying an OoC model against clinical outcomes.

How: The Task Force to facilitate targeted workshops bringing together OoC developers with clinical experts, pathologists, bioinformaticians, and data custodians from both nations to identify suitable disease areas and map available resources. Develop clear, mutually agreed-upon ethical and data-sharing frameworks compliant with both Dutch and Swiss regulations (GDPR, Swiss DPA/Human Research Act) to enable secure and efficient use of clinical data for OoC model validation. Actively seek joint funding (e.g., via EU calls, IHI, or the proposed bilateral "Valley of Death" fund) for flagship projects.

Why: To provide the strongest possible scientific evidence for the predictive power and clinical relevance of NL-CH developed OoC models, thereby

accelerating their regulatory acceptance, adoption by the pharmaceutical industry for decision-making in drug development, and ultimately contributing to personalized medicine and improved patient outcomes.

8. Foster Direct Engagement and Agile Collaboration Alongside Formal Programs

Who: The NL-CH OoC Collaboration Task Force, industry associations (e.g., Swiss Biotech Association, HollandBIO), network organizations (e.g., HDMT, CSEM, TEDD), and event organizers in both countries.

What: Implement a sustained program of activities designed to foster informal, direct B2B (Business-to-Business) and B2R (Business-to-Research) interactions, complementing formal funding programs. This includes organizing at least two targeted NL-CH OoC innovation/matchmaking events annually, alternating locations or focusing on theme-specific areas (e.g., specific disease areas like oncology or neurodegenerative disorders, or technological challenges like automation, AI integration, advanced materials). A key feature of these events should be sessions where industry players present clear problem statements to guide targeted pitches from startups and research groups.

How: Support and co-brand existing successful targeted workshops (e.g., those organized by CSEM or TEDD in Switzerland, or HDMT-related events in the Netherlands) and expand their scope to ensure significant cross-participation. Facilitate "innovation challenges" where industry (pharma, biotech, chemicals, nutrition) from one country can pose specific problems to be solved by innovators (startups, academia) from the other, with seed funding for winning pilot projects. Create and maintain a dynamic, curated joint online portal or database of NL-CH OoC expertise, available technologies, services, and specific collaboration interests.

Why: To leverage the strengths of Switzerland's bottom-up, agile innovation culture and the Netherlands' structured networking capabilities, enabling rapid trust-building, flexible project initiation, and the formation of valuable collaborations that might not emerge through more rigid, formal channels alone, thereby fostering direct, solution-oriented engagement.

9. Incentivize and Support SME Leadership in Joint Projects

Who: National funding agencies (Innosuisse, RVO, SNSF, ZonMw) and the NL-CH OoC Collaboration Task Force.

What: Actively promote and, where possible, adapt funding program criteria (especially for bilateral calls or EU SME-focused instruments like EUREKA Eurostars) to specifically encourage and support Swiss and Dutch Small and Medium-sized Enterprises (SMEs) to take on leading roles (as project coordinators or principal R&D drivers) in joint innovation projects. Aim to have at least 40% of newly funded joint projects significantly driven or led by SMEs within three years.

How: Funding agencies to review and potentially adjust evaluation criteria in relevant joint calls to give more weight to SME-led innovation, commercialization potential, and cross-border value chain creation. The Task Force and funding agencies provide targeted support and mentorship for SMEs aspiring to lead international consortia (e.g., workshops on international project management, IP strategy for collaborations, navigating EU grant administration). Showcase successful SME-led joint projects as inspiring role models.

Why: To directly address Switzerland's "invention vs. innovation" gap by fostering the development of market-ready technologies driven by innovative SMEs, and to empower Dutch SMEs to leverage Swiss technological excellence and market access (e.g., to pharma), thereby strengthening the commercial output and economic impact of the joint ecosystem.

10. Promote Neutral Platforms for Technology Integration, Data Sharing, and Standards Development

Who: The NL-CH OoC Collaboration Task Force, key research institutes with a focus on applied sciences and technology transfer (e.g., CSEM, TNO, relevant Fraunhofer institutes if involved in trilateral projects, HDMT-affiliated core facilities), and industry consortia.

What: Support the creation, or enhance the utilization, of neutral, pre-competitive platforms (e.g., shared laboratories with open access policies, FAIR data repositories for OoC studies, technology integration testbeds, or formal working groups within standardization bodies) by end of 2026. These platforms should facilitate the harmonization of methodologies, the seamless integration of diverse OoC technologies (e.g., microfluidics, sensors, imaging, cell models), and the development of consensus on data formats, quality benchmarks, and validation protocols.

How: The Task Force to identify existing relevant platforms in NL or CH that could be expanded for bilateral use, or identify critical gaps where new neutral platforms are needed. Secure joint funding (public-private partnerships where feasible) to establish or support these platforms, ensuring principles of open access and FAIR data are embedded where appropriate. Encourage active participation from a wide range of stakeholders (academia, SMEs, large industry, regulatory observers) to ensure broad buy-in and prevent dominance by specific proprietary systems. Organize "plugfests" or interoperability challenges to test and promote technology integration and data exchange standards.

Why: To foster broader collaboration by reducing barriers to technology adoption and integration, counteract ecosystem fragmentation, mitigate potential IP challenges associated with integrating multiple proprietary technologies in complex consortia, and build a more cohesive, interoperable, and efficient OoC development environment across both nations.

7. Appendix

7.1. Memorable Statements from Interview Sessions

This section captures key statements from interviews conducted during the study, categorized by stakeholder type. These quotes offer direct insights into the perspectives, challenges, and characteristics of the Swiss Organ-on-Chip ecosystem.

From Large Pharmaceutical Companies

"Switzerland there seems to be almost no structure... everyone is on their own."

- *Highlights the perceived lack of coordination compared to more structured approaches in countries like the Netherlands or France.*

"Switzerland has all ingredients but lacks incentive to collaborate"

- *Reflects the view that while capabilities exist, fragmentation and perhaps a culture of skepticism hinder proactive, large-scale collaboration.*

"We're still very far behind... [in] finding out if we should do things in-house or outsource."

- *Shows the internal debate and uncertainty within large pharma regarding OoC adoption strategies, which can delay external partnerships.*

"If someone would come now... have to say, why should I talk to you?"

- *Underlines the threshold for engagement; pharma requires a clear, compelling value proposition before dedicating resources to interact with startups.*

"We don't have the pots of money... Without money, it doesn't work."

- *Points to internal funding bottlenecks, even within large organizations, for exploring and assessing early-stage external innovations.*

"It's like a stock exchange... you look at what's here"

- *Advocates for more efficient, centralized technology-matching systems and reflects the often transactional nature of how pharma evaluates external technologies.*

"The organ on a chip... doesn't really work. It works with certain things, but not with many things."

- *Expresses managed expectations and skepticism towards overly complex OoC systems perceived as academic "pieces of art" with limited immediate industrial applicability or robustness.*

"We have to combine these two approaches [organoids and assays] to achieve reproducibility."

- *Emphasizes that both the biological model (organoid/tissue) and the measurement method (assay) are critical and must be co-developed for reliable, reproducible results.*

"In the end, there's usually not that much left [from big projects]."

- *Reflects reluctance to commit to large, multi-year consortia or projects due to perceived low return on investment or practical outcomes.*

From Startups & Biotech

"Switzerland's label helps: if it's a Swiss start-up, people trust you'll deliver."

- *Highlights the significant brand value and inherent trust associated with Swiss companies, particularly beneficial for startups building credibility.*

"In Switzerland, you can start a company easily—no red tape for labs or funding, unlike Germany/Austria."

- *Notes the relative ease of the initial company formation process in Switzerland compared to some neighboring countries.*

"Larger equity providers won't touch us until we're profitable. But how do we get there without growth grants?"

- *Articulates the critical funding gap ("Valley of Death") between early-stage funding and later-stage venture capital requiring demonstrated profitability.*

"The HUB moving to Millipore... a huge monster behind it."

- *Expresses concern from some players about the commercialization strategy and potential market dominance of the HUB Organoids initiative, perceived by some competitors as potentially hindering rather than helping the field.*

"Ethical approvals [in Switzerland] are cantonal, slow as hell, and not equipped for this tech."

- *Criticizes the decentralized, cantonal system for ethical approvals for human materials as inefficient, slow, and ill-suited for the pace of advanced technology development.*

"Every company believes their thing is the new standard... none have reached that status."

- *Points to the challenge of harmonization in a field where many players develop proprietary systems, lacking strong incentives (like client demand) for adopting common standards.*

"Technologies are fragmented... the A and O is validation."

- *Reiterates the fragmented nature of the technology landscape and emphasizes that rigorous validation is the most crucial factor ("Alpha and Omega") for success.*

Automation Priority: "Automation is key. Microfluidics aren't scalable without benchmarking."

- *Stresses the critical importance of automation for achieving the scale necessary for robust validation, benchmarking, and eventual industrial use of microfluidic OoC systems.*

Pharma Dynamics: "Pharma internalize tech, then stop collaborations"

- *Highlights a perceived risk for startups when collaborating with large pharma – the possibility that the larger company will absorb the knowledge or technology and then terminate the partnership.*

"Swiss-Dutch could be a crystallization germ for European standards."

- *Expresses a vision for collaboration where joint efforts between Switzerland and the Netherlands could serve as a starting point or catalyst for establishing broader European standards in the OoC field.*

"The risk [of fragmentation] is that everyone wants their own bespoke model... this limits industrialization." (on standardization)

- *Connects the tendency towards customized solutions (driven by fragmentation) directly to the difficulty in achieving the*

standardization needed for industrial-scale production and adoption.

"Swiss startups thrive through patient, organic growth vs. U.S.-style 'disturbing revolutions.'"

- *Contrasts the typical Swiss startup approach, often focused on sustainable, incremental growth based on customer needs, with the more aggressive, high-risk/high-reward "disruptive" model often seen in the US.*

"Switzerland doesn't really have, to my knowledge, a central organization... everyone is on their own."

- *Reinforces the observation of fragmentation and the lack of a central coordinating body or national strategy.*

"It's more like companies develop themselves on skill set they have, which is a lot based on micro-technology and precision engineering."

- *Emphasizes that Swiss company development is often driven organically by leveraging existing national strengths in specific technologies, rather than being guided by top-down initiatives.*

"There is no public funding from the Confederation... it's going to be more private funding."

- *Clarifies the reality of the Swiss funding landscape for companies, highlighting the reliance on private investment rather than direct federal grants.*

From Other Organizations (e.g., Academia, Facilitators, Government-related)

"Switzerland tends to be always a little bit more conservative... things move slower here..."

- *Reflects the perception of Switzerland's policy-making and potentially its adoption of new technologies as being more cautious and slower compared to faster-moving environments like the Netherlands.*

"Advanced cell culture would be anything in the 3D space... microfluidic chambers, etc."

- *Provides context on the scope of technologies included under "advanced cell culture," often the focus of academic research and 3R initiatives.*

"60% of animals used are within academia..."

- *Highlights the significant role of academic research in overall animal use statistics in Switzerland, underscoring why initiatives promoting alternatives (like OoC) often have a strong academic focus.*

"They [Swiss] are extremely proud [...] because they think it's a reason why we're always so high on Europe's innovation scoreboard. They really stand behind this."

- *Explains the cultural attachment to Switzerland's decentralized, bottom-up innovation approach, seeing it as a source of national strength despite acknowledging potential coordination weaknesses.*

"Large pharma in Basel [...] co-funded the European Innovative Health Initiative 15 years ago. Topics important to them are represented there—indirectly."

- *Notes the indirect influence of Basel pharma giants on large European research programs (like IHI), suggesting their strategic interests are represented, even if they don't always lead sector-wide initiatives directly.*

"In Switzerland, we are extremely strong in pharma... but there is a gap between startups and large corporations."

- *Describes the ecosystem structure as having strong players at the small end (startups) and the very large end (pharma), but lacking a robust segment of mid-sized companies in the field.*

"Switzerland is invention world champion per capita, but not innovation champion."

- *Captures the "Swiss Paradox": excellence in generating novel ideas and research ("invention") but relative weakness in translating these inventions into successful, scaled commercial products and market impact ("innovation"), often linked to later-stage funding gaps.*

"Regulatory follows risk management... [data vs. actionable recommendations] are completely different worlds."

- *Highlights a key regulatory principle: the level of scrutiny depends on the intended use and associated risk. Generating research data faces lower hurdles than providing actionable recommendations that influence clinical decisions.*

"More reports and market facts could attract investors to a still-nascent field."

- *Suggests that providing clear market analysis and evidence of potential returns is needed to attract more investment into the OoC field, which may still be perceived as relatively new or risky by some investors.*

7.3 Methodology and Sources Consulted

A. Methodology

This report's findings and recommendations are based on a qualitative analysis designed to provide a comprehensive overview of the Swiss OoC ecosystem, its key characteristics, and opportunities for collaboration with Dutch stakeholders. The methodology involved several components:

1. **Primary Data Collection: Stakeholder Interviews** The core of the data collection consisted of semi-structured interviews conducted during March and April 2025 with key stakeholders from the Swiss OoC landscape. A total of fifteen individuals were interviewed, selected to provide a diverse range of perspectives from various sectors, including:
 - OoC technology developers and biotech companies (startups, SMEs, and established players)
 - Large pharmaceutical companies (end-users and R&D leaders)
 - Academic and research institutions, including research and technology organizations
 - Funding and innovation agencies
 - Investment sector representatives
 - Service and engineering providers supporting the OoC field
2. Interviews were designed to elicit expert insights on the current status and development of OoC in Switzerland, key actors and their expertise, market drivers and trends, existing challenges (such as funding, standardization, and coordination), and perceived opportunities for Dutch-Swiss collaboration.
3. **Data Analysis** Information gathered from the interviews was thematically analyzed to identify recurring patterns, key insights, critical challenges, and strategic opportunities. This synthesis formed the basis for the main findings and recommendations presented in this report. Direct quotations included in the Appendix ("Memorable Statements from Interview Sessions") are used to illustrate these synthesized perspectives.
4. **Secondary Data Review** The analysis was further contextualized by a review of publicly available information, including relevant industry news, organizational

websites, and reports pertaining to the OoC field and innovation policy in Switzerland and the Netherlands.

B. Stakeholder Interviews Conducted

The following individuals generously contributed their time and expertise through interviews conducted in March and April 2025:

- **Christophe Przybyla**, Advanced Microfluidics
- **Olivier Frey**, InSphero
- **Matthias Luetolf**, Institute of Human Biology (IHB), Roche
- **Kleanthis Fytianos**, CSL Behring
- **Jens Kelm**, Precomb
- **Jeroen van den Oever**, Sun Bioscience (*also associated with Doppl*)
- **Nina Hobi**, Alveolix
- **Andy Tonazzi**, Konplan
- **Gilles Weder**, CSEM (Swiss Center for Electronics and Microtechnology)
- **Jenny Bergstroem**, 3R Competence Centre (3RCC)
- **Patrick Misun**, Novartis
- **Peter Geiger**, Family Office Switzerland
- **Adrian Roth**, Roche
- **Gian Nutal Schädli**, CompagOs
- **Sasha Hugentobler**, EUREKA / Innosuisse

(Note: Affiliations are as understood at the time of the interviews and relevant to their contribution to this study.)