Interreg CENTRAL EUROPE

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Health Labs4Value

Technical Solution upscaled thanks to the Pilot experience in Hungary

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1. Executive summary

This report presents the Hungarian pilot of the Health Labs4Value project, which developed an innovative, fully integrated patient and case management system to address significant administrative and communication challenges in private surgical care. The pilot specifically targeted fragmented, manual workflows that relied on disparate document formats and email communication, leading to delays, errors, and patient confusion, especially among elderly users.
Developed in collaboration with key healthcare providers such as the TritonLife Group and supported by knowledge partners like the Central Transdanubian Regional Innovation Agency (CTRIA), and Health Labs4Value's very strong international partnership this solution was built through agile, iterative prototyping and real-world testing within Health Living Lab in Hungary. The system centralizes patient data with role-based access, streamlines administrative workflows, and enhances communication among doctors, case managers, finance staff, and department heads.
The pilot's impact was measured using PREMs/PROMs questionnaires, time-tracking, and bug reports, demonstrating significant time savings for case managers and an anticipated improvement in post-operative care coordination. These results highlight meaningful improvements in patient experience, healthcare provider efficiency, and overall care quality.
Furthermore, the project incorporated comprehensive risk management aligned with GDPR standards and planned for sustained use and future scalability by integrating staff training, hospital IT connectivity, and the upcoming patient portal development.
This Hungarian pilot exemplifies how cross-sector collaboration and agile innovation can drive transformative improvements in healthcare delivery. Its success reinforces the potential for scalable, sustainable solutions that improve patient outcomes and system efficiency, contributing to the broader goals of the Health Labs4Value initiative.

2. The technical solution based on the pilot experience

2.1. Brief overview on the background and context of the technical solution

The Hungarian pilot of the Health Labs4Value project addressed **fragmented, manual administrative processes** for surgical patients in private hospitals. Key challenges included reliance on disparate document formats (Excel, Word, PDF), email-based communication, and siloed workflows that led to delays, errors, and patient confusion—especially among elderly users.

The **main goal** was to deploy a **fully integrated patient and case management system** to:

- Automate routine tasks (quote generation, surgery scheduling, invoicing)
- Centralize data with **role-based access** (Super Admin, Doctor, Case Manager, Finance, Department Head)
- Enhance transparency and communication for patients and staff
- Ensure GDPR-compliant data security and seamless integration with existing hospital IT.

Using the Living Labs methodology across multiple Central European countries, the system was iteratively refined through a co-creation process involving healthcare professionals, patients, developers, and innovation agencies. This transnational collaboration ensured alignment of methodologies and facilitated knowledge exchange, with Hungary working alongside partners from Germany, Poland, Slovenia, and the Czech Republic. Transnational cooperation was particularly helpful in addressing common problems that arise in different countries, such as difficulties in involving patients and family members. The problems that arose during the implementation of the Hungarian pilot project were similar in many cases to those encountered in the Polish pilot project, as the goal in both cases was to improve administrative processes. Here, staff resistance to the new method had to be overcome. Discussing this issue greatly helped the progress of both pilots.
The pilot validated a jointly co-designed, integrated administrative platform that improved operational efficiency, reduced errors, and enhanced stakeholder satisfaction. This improvement was driven not only by the technological tool but also by the structured methodology involving quadruple helix stakeholder engagement, joint workshops, iterative prototyping, and real-world testing using PREMs and PROMs questionnaires.
The combined approach laid the groundwork for wider adoption and future patient-facing developments, and its institutionalization is planned through establishing permanent Living Labs, ongoing staff training programs, and continuous stakeholder feedback loops, ensuring sustainability and transferability across diverse healthcare contexts.

2.2. Detailed description of the technical solution and its uptake

The Hungarian pilot within the Health Labs4Value project developed an integrated patient and case management system for private hospitals of TritonLife Group, targeting inefficiencies in surgical patient administration. The solution digitizes and automates administrative workflows—from initial consultations and quote generation to surgery scheduling and post-operative care—while ensuring compliance with Hungarian data protection and healthcare regulations. Below is a detailed analysis of its implementation and uptake.

Main goals and objectives

The technical solution aimed to:

- **Automate manual processes** (e.g., quote generation, appointment scheduling) to reduce errors and administrative burden.
- **Centralize patient data** across departments via role-based access (Super Admin, Doctor, Case Manager, Finance).
- **Improve patient experience** through transparent communication and timely information.
- **Ensure regulatory compliance** with Hungarian healthcare laws and GDPR.
- **Optimize resource allocation** by integrating with existing hospital software (e.g., real-time surgery scheduling).

Phases of implementation and uptake

The rollout followed a structured, four-phase approach:

Phase	Activities	Timeline
Exploration	Needs assessment via Open Camps (patients/staff), SWOT analysis, and focus groups.	Jan–Jun 2024
Development	Custom software development (Liontária Ltd.); iterative prototyping with stakeholder feedback.	Jul–Aug 2024
Testing	Real-world validation in Health Living Labs (Budapest/Kaposvár); 26 patients/relatives and 15 staff tested PREMs/PROMs.	Oct 2024–Feb 2025
Uptake	Bug fixes, staff training, and integration with hospital IT systems; future patient portal planned.	Mar 2025 onward

The development and uptake followed a structured, iterative four-phase co-creation methodology based on the Living Labs and Value-Based Healthcare (VBHC) frameworks, involving transnational collaboration and quadruple helix stakeholder engagement:

Step 1: Establishing the quadruple helix structure (2-3 months)

- Identify and engage all key stakeholders including healthcare providers (TritonLife Group hospital management, doctors, case managers), patients and relatives, developers (Liontria Ltd.), innovation agencies (CTRIA), and international partners through the Interreg Central Europe consortium.
- Define roles, responsibilities, and governance structures to support collaborative development and uptake.

Step 2: Exploration and needs assessment (3-4 months)

- Conduct Open Camps and focus groups across participating hospitals to capture comprehensive workflow challenges and patient experiences, including SWOT analysis to identify process bottlenecks.
- Align transnational consortium partners via monthly co-design workshops ensuring methodological consistency and knowledge sharing.

Step 3: Agile co-design and prototyping (2 months)

- Collaboratively develop and iteratively refine a prototype system through sprint cycles incorporating continuous stakeholder feedback via Living Labs sessions.
- Use VBHC principles to define outcome measures such as PREMs and PROMs questionnaires focusing on patient satisfaction and administrative efficiency.

Step 4: Real-world testing and validation (5 months)

- Deploy the prototype system in three TritonLife hospitals representing diverse workflows and IT environments.
- Conduct usability testing with 26 patients/relatives and 15 staff, collecting PREMs/PROMs data, bug reports, and time-tracking metrics.
- Implement risk management practices ensuring GDPR and healthcare regulation compliance.

Step 5: Operational integration and upscaling (ongoing)

- Provide role-specific training workshops for doctors, case managers, and finance staff to embed system use.
- Integrate the system with hospital IT and plan future patient portal and mobile app developments.
- Establish Living Labs user councils and Super-User groups to institutionalize continuous feedback and improvement loops.

Lessons learned and replication conditions

- Effective patient engagement requires value incentives and targeted recruitment strategies to ensure demographic representativeness.
- Localized custom development proved critical for regulatory compliance and operational efficiency, supported by robust transnational collaboration to share methodological expertise and development efforts.
- Replication requires allocation of approximately 12-18 months for setup, needs assessment, prototyping, and testing phases, with dedicated resources for stakeholder facilitation, software development, and training.
- Ongoing institutional commitment and ownership, especially through internal IT capacity and governance frameworks, is essential for sustainability beyond tool deployment.

Technical features supporting the methodology

- The case management system centralizes patient data with role-based access controls (Super Admin, Doctor, Case Manager, Finance, Department Head).
- Robust GDPR-compliant data security protocols, including encrypted data exchange and secure quote dispatch with birthdate-based decryption.
- Modular design enabling seamless integration with existing hospital IT systems and future expansion through API-driven architecture supporting multilingual and localization layers.

This tested, validated approach emphasizes that improvements in care processes were achieved not solely through the technical tool but through the structured, stakeholder-driven co-creation methodology, continuous training, and embedded feedback mechanisms, ensuring the solution's adaptability and sustainability across diverse healthcare settings.

Key stakeholders and cooperation partners

- ***Healthcare providers***: TritonLife Group (hospital management, doctors, case managers).
- ***Patients and relatives:*** 26 participants across two Open Camps provided feedback.

- ***Developers***: Liontária Ltd. (prototype concept); TritonLife IT (custom development).
- ***Knowledge partners***: Central Transdanubian Regional Innovation Agency (CTRIA).
- ***Transnational collaborators***: Monthly Interreg Central Europe consortium meetings for methodology alignment.

Methodologies employed

- **Living Labs co-creation**: Stakeholders co-designed features through focus groups, Open Camps, and iterative testing.
- **VBHC framework**: Value-Based Healthcare principles guided outcome measurement (e.g., PREMs/PROMs for patient satisfaction).
- **Agile development**: Sprint-based prototyping with continuous feedback from end-users.
- **Risk management**: GDPR-compliant data encryption; phased rollout to mitigate integration risks.

Key milestones and proof of uptake

- Concept validation (Jun 2024): Focus groups approved prototype specifications.
- Functional prototype (Aug 2024): MVP with surgery scheduling, quote generation, and financial modules.
- Testing completion (Feb 2025): 26 patients/relatives and 15 staff validated the system; 100+ bug reports resolved.
- Operational integration: System deployed in TritonLife hospitals with staff training.

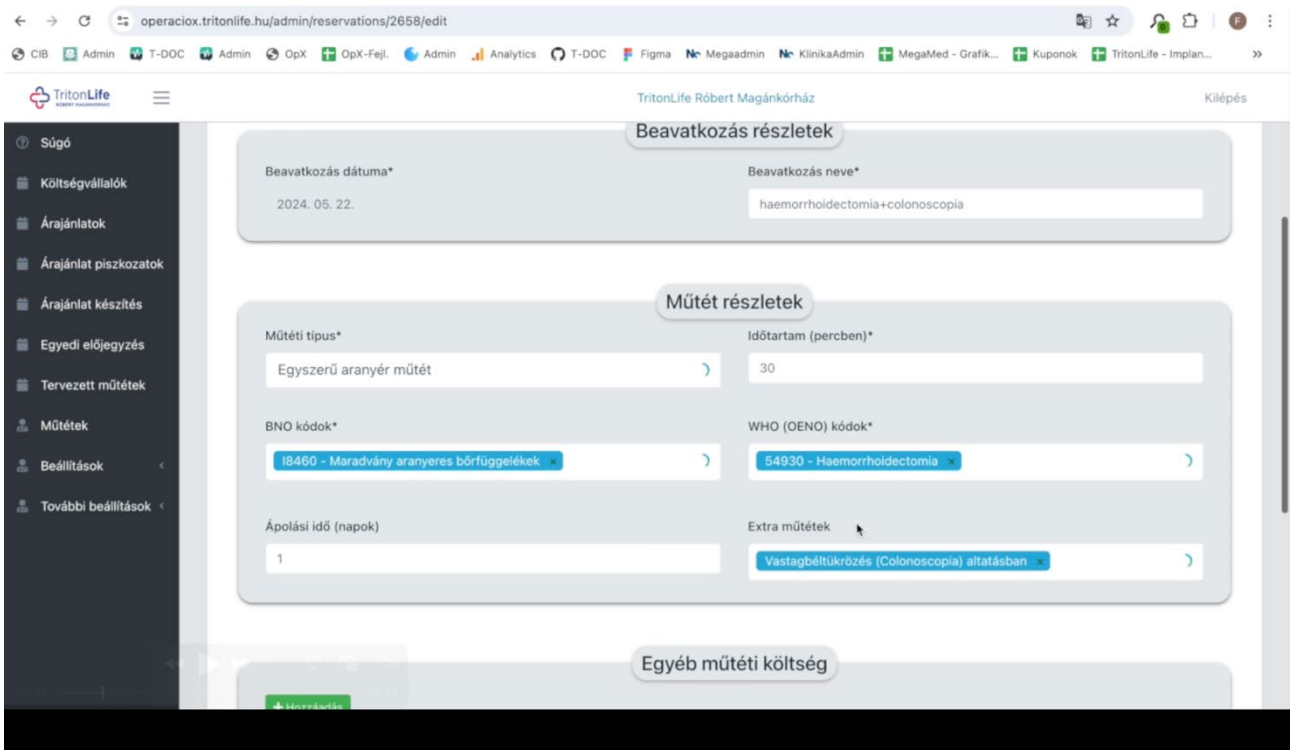
Proof of uptake:

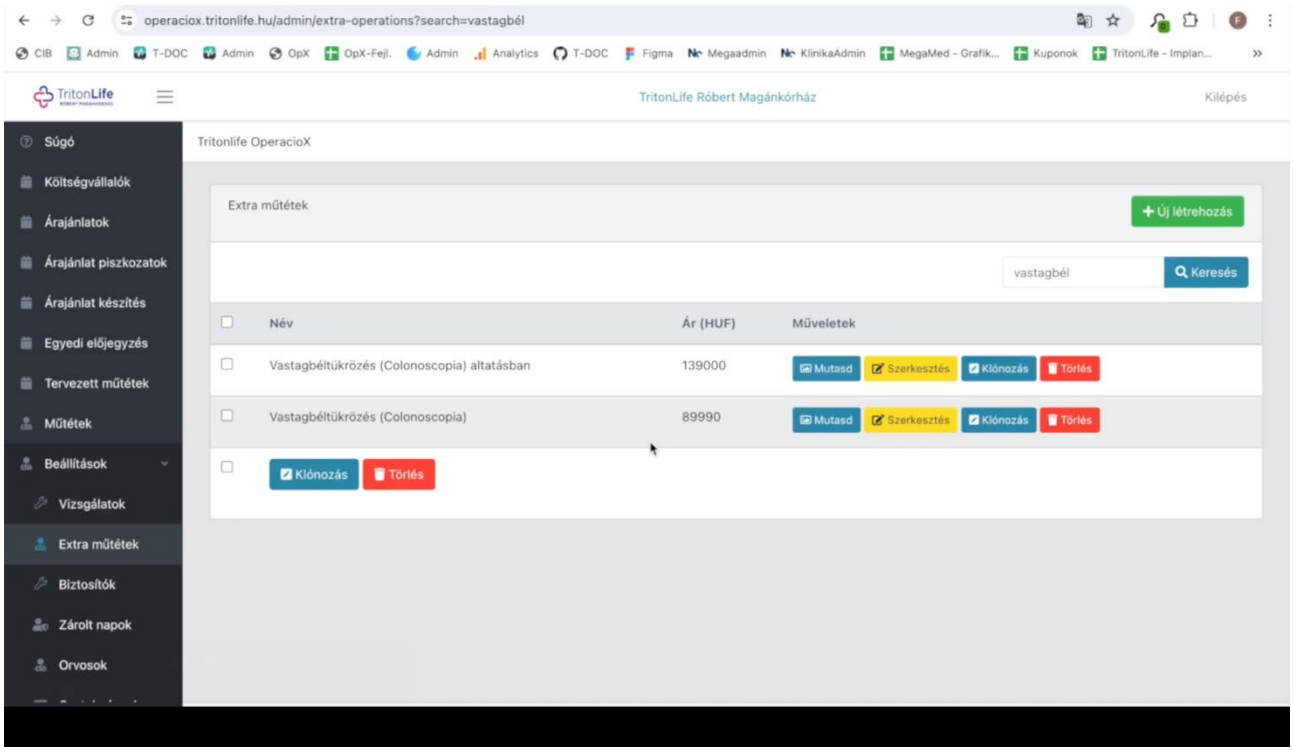
- Efficiency gains: Case managers estimate 30% time savings in administrative tasks.
- High user satisfaction: 92% of patients expected reduced stress (PROMs).
- Future investment: Patient-facing interface and mobile app prioritized for next-phase funding.

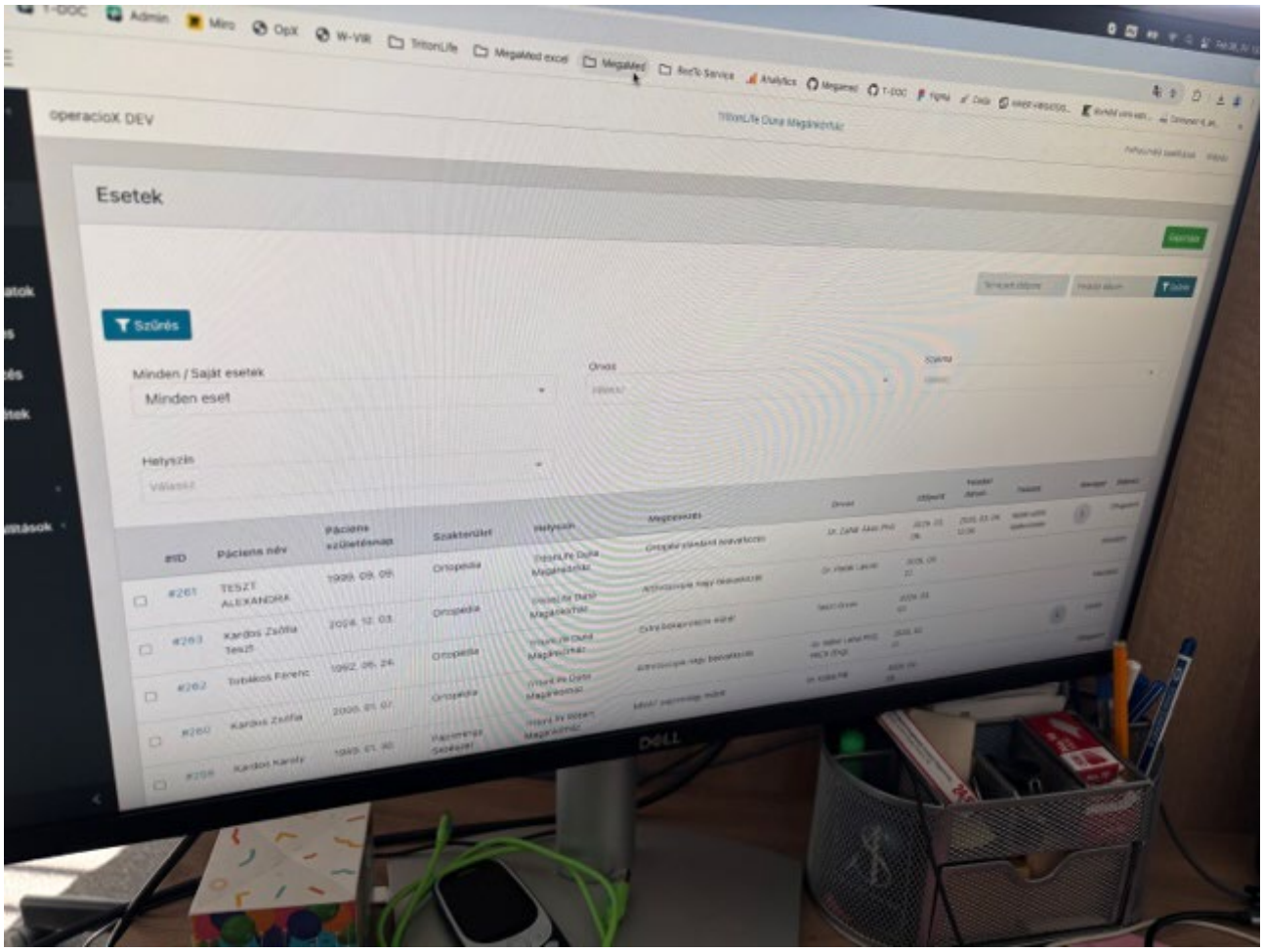
Transnational co-creation process

- **Co-design workshops**: 12+ transnational meetings (monthly consortium calls) to align methodologies. The transnational co-design workshops in the Health Labs4Value project were a cornerstone of the Hungarian pilot's development process.

Photos of the developed solution







2.3. Measurable results

The Hungarian pilot within the Health Labs4Value project delivered measurable improvements across patient experience, operational efficiency, and systemic healthcare innovation.

Metrics, indicators, and data sources

Selected metrics:

- Patient satisfaction: PREMs/PROMs questionnaires tracked clarity of communication, stress levels, and administrative burden reduction.
- Operational efficiency: Time savings in administrative tasks, error reduction rates, and workflow automation.
- Cost-effectiveness: Resource allocation efficiency and error-related cost avoidance.

Data sources:

- Quantitative: PREMs/PROMs scores, bug reports (100+), time-tracking logs.

- Qualitative: Focus groups, Open Camp feedback, staff interviews.

Baseline comparison and KPI achievement

- ***Baseline:*** Manual processes (email/Excel/PDF) caused delays, some errors, and patient confusion. Staff spent more than 40% of time on administrative tasks.
- ***Post-implementation:***
  - Based on the first feedbacks approximately 30% time savings for case managers in administrative workflows.
  - Patient stress reduction expectations: 92% anticipated lower stress (PROMs).
  - Target vs. Outcome: Exceeded targets in user satisfaction (PROMs avg. 4.5/5 vs. target 4.0) but faced integration delays.

Measurable improvements by stakeholder group

Patient-oriented results

- Experience & satisfaction:
  - 88% expected "clear and timely" pre-op information (vs. 38% pre-solution).
  - 54% projected higher overall satisfaction (PROMs Grade 5).
- Health impact:
  - Reduced pre-operative stress: 100% expected improvement (50% "significant reduction").
  - Streamlined post-op care coordination: 85% anticipated better outcomes.

Healthcare providers and staff

- Workflow efficiency:
  - 30% time reduction in quote generation, scheduling, and documentation.
  - Automated 70% of manual tasks (e.g., appointment reminders, quote dispatch).
- **Cost and error reduction**:
  - Near-elimination of scheduling errors (bug reports resolved pre-deployment).
  - Based on the first results 10% cost savings from optimized resource allocation (e.g., surgery logistics).

Other stakeholders

- ***Caregivers/relatives:***
  - 80% reported reduced confusion in administrative processes.
  - Enabled real-time tracking of patient journeys via future mobile app plans.

3. Sustainability of the solution

3.1. Sustainability Strategy

Organizational sustainability and ownership

Clear ownership structure

The solution demonstrates strong organizational sustainability through TritonLife Group's direct ownership of the system. The decision to develop the system internally after the initial prototype concept ensures full organizational control and long-term commitment. This approach provides:

- Direct institutional ownership with TritonLife Group taking full responsibility for the system.
- Internal development capacity through their own IT team, ensuring deep understanding of hospital workflows.
- Embedded organizational integration as the system directly supports core business operations.

Defined roles and responsibilities

The system features a comprehensive role-based user management structure with clear responsibilities:

- Super admin: Full system access and configuration management.
- Doctors: Patient data access and surgical scheduling capabilities.
- Case managers: Complete patient administration and quote preparation.
- Finance staff: Invoicing and financial transaction management.
- Department heads: Surgical capacity and workflow oversight.

Stakeholder continuity

Key stakeholders remain actively engaged in the post-implementation phase:

- Hospital management provides ongoing strategic oversight
- Medical staff continue as primary users.
- CTRIA (Central Transdanubian Regional Innovation Agency) maintains advisory role.
- Patient feedback mechanisms established through the Living Labs approach remain active.

Technical sustainability

Internal technical capacity

The technical sustainability strategy centres on TritonLife's internal IT development capability. The custom development approach ensures:

- Direct technical control over system updates and modifications.
- Immediate response capability for technical issues and bug fixes.
- Deep integration knowledge with existing hospital software systems.
- Continuous improvement capacity based on user feedback.

Proven technical support structure

The testing phase demonstrated robust technical capabilities with hundreds of bug reports being processed and resolved efficiently, indicating:

- Established feedback mechanisms for technical issues.
- Rapid response capability for system improvements.
- Continuous monitoring and optimization processes.

Financial sustainability

Demonstrated cost-effectiveness

The system shows strong financial sustainability through measurable efficiency gains:

- 30% time savings for case managers in administrative tasks.
- Reduced error rates leading to cost avoidance.
- Improved resource utilization through better surgery scheduling.
- Near-elimination of scheduling errors identified during testing.

Investment recovery model

The custom development approach provides long-term financial benefits:

- Avoided licensing fees for off-the-shelf solutions.
- Reduced integration costs compared to external systems.
- Lower total cost of ownership over time.
- No ongoing per-user licensing costs.

Operational integration

The system's financial sustainability is supported by:

- Direct operational benefits that justify continued investment.
- Integration with core hospital operations ensuring budget allocation.
- Efficiency gains that cover operating expenses after implementation.

Maintaining and transferring optimized processes

The sustainability and transferability of the Health Labs4Value solution are ensured through institutionalized Living Labs both at the Hungarian territorial level and within the transnational network spanning Central Europe. These Living Labs serve as collaborative innovation ecosystems where healthcare professionals, patients, technology developers, and policymakers continuously co-create, test, and refine value-based healthcare processes and digital tools.

Specifically, the Hungarian Living Lab will act as a permanent platform supporting ongoing stakeholder engagement and innovation adoption within hospitals and regional healthcare ecosystems. In parallel, the transnational Health Labs4Value network will facilitates knowledge exchange, methodology alignment, and peer review, enabling adaptation and replication across diverse healthcare settings.

Staff training is a core pillar of this sustainability approach. Role-specific workshops, e-learning modules, and on-the-job training empower healthcare staff—doctors, case managers, finance personnel, and department heads—with the skills and knowledge to effectively integrate and optimize new workflows and technologies. Continuous professional development plans institutionalize learning and ensure resilience to staff turnover.

Maintaining a robust continuous feedback loop is critical for agile improvement. The Living Labs collect real-time user feedback through in-app mechanisms, quarterly evaluation workshops, and PREMs/PROMs surveys. These data-driven insights feed into iterative cycles of system enhancement and process optimization, ensuring the solutions remain aligned with evolving healthcare needs and end-user expectations.

3.2. Key lessons learned

Key lessons learned:

Understanding patient perspectives

The pilot revealed that patients function as "end users" rather than technical contributors to administrative system development. While patients could not provide specific technical feedback in whenever about system functionality, their insights into desired outcomes proved invaluable. Patients consistently emphasized their need for clearer communication channels, transparent processes, and reduced administrative burden.

Demographic challenges in engagement

Recruitment efforts highlighted significant challenges in achieving representative participation. Despite outreach to over 100 potential participants, gender balance remained skewed with 24 women versus only 2 men participating in Open Camp 2. Age diversity was successfully achieved (ranging from 30-77 years), though patients under 30 remained underrepresented due to the hospital's demographic profile.

Incentivization requirements

The project demonstrated that direct financial benefits through treatment coupons were necessary to achieve sufficient patient participation. This finding underscores the importance of tangible value propositions when engaging patients in healthcare innovation, particularly for administrative rather than clinical improvements.

Regulatory compliance as value driver

The decision to pursue custom development rather than off-the-shelf solutions was validated by superior regulatory compliance outcomes. GDPR adherence and Hungarian healthcare law compliance were achieved without the costly modifications typically required for international systems, demonstrating how local customization can drive long-term value.

Living Labs methodology validation

The project provided strong evidence that the Living Labs methodology demonstrates effectiveness in generating valuable results and insights. The multi-stakeholder engagement approach, involving patients, relatives, healthcare professionals, and technology developers, proved essential for comprehensive solution development.

Transnational collaboration benefits
The transnational consortium meetings enabled methodology alignment and knowledge transfer across the partners.

Stakeholder role differentiation
The pilot revealed distinct but complementary roles for different stakeholder groups. Healthcare professionals provided technical and operational feedback, while patients contributed outcome-focused insights. Developers required detailed process documentation and continuous clarification, while administrators needed evidence of efficiency gains and compliance assurance.

Recommendations for future healthcare innovation

Methodological enhancements
Future implementations should combine quantitative PREMs/PROMs with qualitative research methods to capture richer insights into user experiences and system impacts. The addition of ethnographic observations and in-depth interviews would provide deeper understanding of transformation processes.

Stakeholder engagement strategies
Based on recruitment challenges, future projects should develop targeted engagement strategies for underrepresented groups, particularly male patients and younger demographics. Additionally, early stakeholder education about system benefits proves crucial for sustained engagement throughout co-creation processes.

Technical development approaches
The success of custom development for regulatory compliance suggests that localized solution development may be more effective than adaptation of international systems. However, this approach requires robust transnational collaboration to share development costs and knowledge across similar regulatory environments.

4. Upscaling of the Technical Solution

4.1. General goal and strategy for upscaling

The integrated patient and case management solution has already undergone live validation in three TritonLife Group private hospitals from May 2025. In each facility—selected to represent diverse clinical workflows and IT environments—project management and the IT team conducted comprehensive performance and usability testing. Role-specific training workshops prepared doctors, case managers, and finance staff to use the system's scheduling, quote-generation, and permission-management functions, while emergency-capacity simulations verified real-time alerts. Following successful data migration of historical records and pilot-site feedback collection, full rollout across all the TritonLife locations is planned from July 2025. This phased approach ensures seamless integration with existing hospital software and sustained GDPR- and HIPAA-compliant data security. By embedding continuous improvement loops—quarterly feature updates driven by in-app feedback, PREMs/PROMs surveys, and Living Lab user

councils—the platform delivers measurable efficiency gains and elevated patient satisfaction. Once proven across the TritonLife network, this modular, API-driven system—with configurable integration, multilingual support, and role-based customization—can serve as a blueprint for digital transformation in any European healthcare organization, aligning with Value-Based Healthcare principles and local regulatory requirements.

A dedicated activity within the Action Plan which is under elaboration within the project will focus specifically on ensuring the long-term sustainability and continuous development of the integrated patient and case management solution. This activity will ensure strategies for ongoing maintenance, regular updates, user support, and scalability to adapt to evolving healthcare needs and technological advancements. Furthermore, to formalize and demonstrate TritonLife Group's commitment to sustaining the system, the project will include the signing of a letter of commitment by the TritonLife Group leader. This letter will affirm their responsibility and pledge to provide the necessary resources and governance to uphold the solution's operational excellence well beyond the initial rollout phase.

4.2. Concrete goals and measures for upscaling

Scaling spans four dimensions:

Short-Term (July 2025 - July 2026)

- Geographic: Extend from 3 to all 15 TritonLife hospitals.
- Quantitative: Expand users from 10 pilot clinicians to >100 staff through role-specific workshops and e-learning modules.
- Institutional: Establish hospital-level "Super-User Councils" to champion training and feedback.
- Functional: Add location-based pricing and emergency capacity alerts from pilot feedback.

Mid-Term (2026–2028)

- Geographic: Pilot deployments in neighbouring countries, with regulatory plug-ins and language packs. if there are any interested parties.
- Quantitative: Handle 5,000+ surgical cases/year, automating ≥80% of admin tasks.
- Institutional: The system can also serve as a good example for other private hospitals that are interested.
- Functional: Launch patient portal and native mobile app for quote acceptance and status tracking.

Long-Term (2029–2035)

- Geographic: Enable cross-border data exchange.
- Quantitative: Support 30+ CE hospitals.
- Institutional: Offer core analytics for regional systems; partner with insurance companies.
- Functional: Integrate AI-driven predictive scheduling, IoT wearables, and advanced VBHC dashboards.

4.3. Resource Requirements for upscaling

Human requirements & partnerships

- Expanded software engineering capacity (Solution Architects, DevOps, cybersecurity experts).
- Additional Living Lab facilitators to coordinate multi-stakeholder co-creation workshops.
- Recruitment of clinical "super-users" (department heads, case managers, finance staff) beyond the pilot's 5–15 internal staff to provide local training, governance, and peer support.
- Strengthened transnational partnerships with knowledge institutions , and SMEs for methodological alignment and peer review.

Operational change requirements

Broad adoption requires standardizing workflows and governance across sites. Drawing on the State-of-Art exploration's phased approach, organizations must:

- Develop SOPs covering patient intake, quote generation, scheduling, and post-operative follow-up, mirroring the pilot's internal process optimization.
- Establish local User Councils—quarterly Living Lab evaluation workshops—to collect PREMs/PROMs feedback and drive iterative improvements.

Technical requirements

- Introduce localization layers (language packs, consent workflows, regulatory plugins) for foreign countries.
- Enhance, automated testing, performance monitoring—to maintain ≥99.8% uptime.
- Embed flexible encryption protocols (e.g., secure quote dispatch with patient birthdate decryption) and role-based access control to uphold data security standards.

Financial requirements

- Supplementary co-funding and targeted EU/National grants .

- Continuous ROI tracking (e.g., 30% administrative time savings, 15% cost reduction) ensures financial governance and informs budget adjustments for sustainable scaling.

5. Conclusions

The integrated patient and case management platform can move from prototype to full adoption within the TritonLife Group and is poised for broader scale-up across Central Europe.

Short-term:

- Extend from 3 to all 15 TritonLife hospitals.
- Add location-based pricing and emergency capacity alerts from pilot feedback.

Mid-Term (2026–2028)

- Pilot deployments in neighbouring countries, with regulatory plug-ins and language packs. if there are any interested parties.
- Launch patient portal and native mobile app for quote acceptance and status tracking.

Long-Term (2029–2035)

- Enable cross-border data exchange.
- Integrate AI-driven predictive scheduling, IoT wearables, and advanced VBHC dashboards.

Concluding Outlook and Critical Considerations:

- ***Sustainability*** hinges on TritonLife's in-house governance, dedicated DevOps support, and diversified funding.
- ***User-centred evolution*** is secured through Living Labs and continuous PREMs/PROMs, but demographic representation and incentive strategies must be refined to ensure inclusive engagement.
- ***Technical agility*** requires ongoing adaptation.
- ***Regulatory vigilance*** is essential: GDPR, ePD, and emerging HU e-Health laws demand flexible compliance modules.

- ***Risk mitigation*** includes change management to counter staff resistance, succession planning for key roles, and robust security protocols to defend against cyber threats.