

IMPLEMENTING DIGITAL MEDICATION MANAGEMENT IN HOSPITALS

7 September 2026



EHMA

European Health Management Association

EHMA is a non-profit membership organisation that focusses on enhancing the capacity and capability of health management to deliver high-quality healthcare.

Since 1982, EHMA has helped drive solutions and ideas to enable resilient health systems. Strong health management. Relevant knowledge transfer. More sustainable practices.

Our impact is long-lasting.

ABOUT EHMA



OUR WORK ON MEDICATION MANAGEMENT

- In 2022 EHMA established the EPACT Alliance, bringing together patient organisations, healthcare professionals, hospital managers, industry and other stakeholders.
- Over time, EPACT has evolved into a platform connecting European policy, evidence generation and practical implementation. The initiative has addressed issues ranging from digital infrastructure and health data to medicine shortages, patient safety, controlled substances, sustainability, and workforce capacity.
- EPACT has contributed to discussions surrounding the European Health Data Space, the Pharmaceutical Strategy for Europe, the Critical Medicines Act and the future Multiannual Financial Framework.
- EPACT has developed practical guidance for healthcare organisations through research, implementation guides, funding recommendations, and workshops.

AGENDA

Introduction (5 minutes)

Federica Margheri, Executive Director, EHMA

Practical implementation guidance (30 minutes)

Presentation of our White Paper and Managers' Guide

Alexis Strader, Director of Policy and Research, EHMA

Expert reflections (30 minutes)

Practical implementation experiences from hospital settings

Patrick van Oirschot, Co-Founder, The Asclepius Project

The business case for digitalisation (30 minutes)

Return on investment of digital medication management

Dr Daniele Bellavia, Research Associate, LIUC University

Q&A and discussion (20 minutes)

Conclusions (5 minutes)

Federica Margheri, Executive Director, EHMA





Alexis Strader

Director of Policy and Research
European Health Management Association (EHMA)

DIGITAL MEDICATION MANAGEMENT IN HOSPITALS

From policy priorities to
practical implementation

Alexis Strader

DIGITALISATION OF MEDICATION MANAGEMENT IN HOSPITALS

From the EHMA White Paper (2022) to the How-To Managers' Guide (2025)

The challenge

Medication management remains fragmented, manually intensive and insufficiently traceable in many European hospitals

The opportunity

Connect the pathway—from stock to bedside—to improve patient safety, hospital resilience, workforce capacity and data quality

Today's focus

1. What gaps did the White Paper identify?
2. What did EHMA recommend?
3. How can your hospital use the Guide to move from ambition to implementation?



MEDICATION MANAGEMENT IS A STRATEGIC HOSPITAL FUNCTION

- It covers the full pathway: ordering, reception, storage, prescribing, compounding, dispensing, administration and monitoring.
- Medication errors are among the most common adverse events in hospitals and affect patients, staff capacity and hospital resources.
- In OECD countries, medication-related harm during hospitalisation affects 1 in 20 patients.
- The 2022 White Paper estimated preventable medication-related harm costs at more than €54 billion across OECD countries.
- Digitalisation is not simply an IT upgrade: it is an investment in safer care, operational efficiency, supply resilience and usable data.



2022: EHMA'S FOUNDATIONAL CALL TO ACTION

The White Paper, *Digital medication management in healthcare settings: an opportunity for the European Union*, made the case for digitalising hospital medication pathways as a European health-system priority.

ITS CORE PROPOSITION

Digital medication management should be treated as essential hospital infrastructure—not as an optional technology project.

Why the European dimension matters

Digital medication management supports:

- Patient safety and reduction of avoidable errors
- Hospital preparedness and medicine-shortage management
- Efficient use of medicines and reduced waste
- Workforce resilience and safer working environments
- Interoperable data for care, research, regulation and innovation



DIGITALISATION GAPS IDENTIFIED IN EUROPEAN HOSPITALS

The 2022 White Paper drew on an ECAMET study of 317 hospitals in 13 European countries. It found uneven uptake of digital tools and particularly weak integration between systems.

Medication-management component	Evidence of the gap
Pharmacy inventory management	66% had a pharmacy information system, but only 18% had pharmacy robots
Electronic prescribing	94% had CPOE, but only about 20% integrated clinical decision support
CPOE interoperability	Only 50% integrated with electronic medical records; 33% with medication cabinets; <20% with infusion pumps
Automated dispensing cabinets	Available in only 25% of ICUs and 16% of oncology wards
Electronic compounding	Available in 14% of ICUs; much preparation remained manual and outside central pharmacy
Barcode medication administration	Available in <30% of surveyed hospitals
Smart pumps with dose-error-reduction software	Available in <20% of hospitals; <15% monitored infusions centrally

THE WHITE PAPER'S RECOMMENDATIONS

1 Invest in hospital digital medication infrastructure

Support interoperable systems that connect stock management, prescribing, preparation, dispensing and administration

2 Standardise identification and traceability

Expand use of global identification and barcoding standards to enable safer, trackable medication processes

3 Make change management and workforce skills fundable

Digitalisation requires protected time, training, multidisciplinary engagement and a culture of safety – not only hardware and software

4 Generate high-quality medication data

Enable real-time visibility of medicine supply and demand, support shortages management, and create data suitable for care, research and policy.

5 Align policy and implementation

Ensure hospitals can meet evolving EU expectations related to medicine shortages, pharmaceutical policy and health-data interoperability.

THE HOW-TO MANAGERS' GUIDE: A PRACTICAL IMPLEMENTATION FRAMEWORK

The 2025 Guide translates the White Paper's policy ambition into a structured pathway for hospital leaders, pharmacists and multidisciplinary implementation teams.

It helps hospitals to:

- Understand the full medication-management pathway and where risks occur
- Assess organisational, technical, financial and workforce readiness
- Build a compelling business case for investment
- Engage clinical, pharmacy, IT, finance and procurement stakeholders
- Plan procurement, implementation, training and go-live
- Monitor outcomes and sustain continuous improvement



WHERE SHOULD YOUR HOSPITAL START?

Digital medication management does not need to begin everywhere at once. Start where the safety risk, operational burden or lack of visibility is greatest.



If your priority is...	Consider starting with...
Limited visibility of stock, expiry and shortages	Digital inventory management / pharmacy information systems
Prescribing errors or incomplete clinical checks	Electronic prescribing and clinical decision support
Risks in high-risk medicine storage on wards	Automated dispensing cabinets
Manual preparation, labelling or dose calculation	Electronic compounding / gravimetric preparation
Wrong patient, medicine, dose or time at bedside	Barcode medication administration
Infusion-programming errors	Smart pumps with dose-error-reduction software

BEFORE IMPLEMENTATION: ASSESS READINESS ACROSS SIX DIMENSIONS

People and culture

Can new tools connect safely with EHR, CPOE, pharmacy, cabinet and infusion systems?



Workflow and safety

Have we mapped current processes, risks and workarounds?



Technology and interoperability

Can new tools connect safely with EHR, CPOE, pharmacy, cabinet and infusion systems?



Data, privacy & cybersecurity

Are access controls, audit trails, data governance and vendor responsibilities clear?



Finance and resources

Have we costed technology, integration, implementation, training, backfill and maintenance?



Governance & regulation

Who owns decisions, risk management, compliance and benefits realisation?



A STRONG BUSINESS CASE CONNECTS PATIENT SAFETY AND FINANCIAL STEWARDSHIP

A business case should answer six questions:

1. **What is the problem?** Quantify the current safety, workflow, stock or compliance gap
2. **What is the proposed solution?** Define scope, users, interfaces and implementation approach
3. **What benefits are expected?** Safety, efficiency, stock, waste, workforce and compliance
4. **What will it cost?** Technology, integration, implementation, training, maintenance and contingency
5. **What are the risks?** Change resistance, downtime, interoperability, cyber risk and implementation disruption
6. **How will success be measured?** Baseline, KPIs, ownership and review cycle

IMPLEMENTATION NEEDS LEADERSHIP SUPPORT AND COLLABORATION

The Guide recommends:

Leadership buy-in

Align the initiative with hospital strategy, secure resources and create organisational momentum.

A dedicated project team

Define responsibilities for project management, clinical input, pharmacy expertise, system integration, training and compliance.

Early stakeholder engagement

Involve clinicians, pharmacists, IT staff and administrative personnel in needs assessment, planning and decision-making.

Collaboration across functions

Bring pharmacy, finance and IT together to develop a credible business case and implementation plan.

Change champions and transparent communication

Support adoption by engaging staff early, responding to concerns and creating channels for feedback.



What creates buy-in?

- Engage staff early, not after the solution has been selected
- Appoint visible clinical and pharmacy change champions
- Communicate what will change, why it matters and where support is available
- Use pilots and feedback loops to adjust

PLAN FOR SAFE GO-LIVE AND FOR CONTINUOUS IMPROVEMENT

Before go-live

- Define a phased versus hospital-wide rollout strategy
- Complete technical integration and user-acceptance testing
- Train users by role, workflow and clinical setting
- Establish escalation routes, downtime processes and at-the-elbow support
- Communicate precisely what changes on day one

After go-live: monitor what matters

- Medication-error rates and near misses
- System availability and downtime
- Barcode scan compliance or other process-adherence indicators
- Stockouts, expiry-related waste and inventory accuracy
- Time spent on medication-related tasks
- User satisfaction, workarounds and training needs

Prepare → Pilot → Train → Go live → Stabilise → Optimise

**Start with your hospital's
highest-priority
medication-management
challenge and use the
Guide to turn it into a
structured implementation
plan**

THANK YOU

WWW.EHMA.ORG 



Patrick van Oirschot

Co-Founder

The Asclepius Project

IMPLEMENTING DIGITAL MEDICATION MANAGEMENT IN HOSPITALS



Expert reflections
From guidance to implementation
reality



Patrick van Oirschot
Co-Founder, The Asclepius Project | Owner, GPP Support

EHMA Online Masterclass

7 September 2026



START

DESTINATION

Safer, more efficient
and sustainable
medication management

START



1. PREPARE

Assess needs
and readiness



2. ENGAGE

Align stakeholders
and build the team



3. PLAN

Define scope
and business case



4. PROCURE

Select solutions
and partners



5. IMPLEMENT

Integrate, test
and train



6. GO-LIVE

Start, support
and stabilise



7. IMPROVE

Measure, learn
and scale

DESTINATION

Safer, more efficient
and sustainable
medication management



And then reality happens.

**Lessons from implementing digital medication management in
real hospitals**



DESTINATION

Safer, more efficient
and sustainable
medication management

- New priorities →
- Additional scope →
- Regulatory changes →
- Technical issues →
- Resource constraints →

START

DETOUR

DETOUR

**ROAD
CLOSED**

**EXPECT
DELAYS**



DESTINATION

Safer, more efficient
and sustainable
medication management

Organisational
resistance

Staff training
and adoption

Regulatory
and compliance
requirements

Unexpected
dependencies

Budget
constraints

DETOUR
→

REALITY
CHECK

Technical
challenges

Stakeholder
alignment takes
longer than expected

Changing
priorities

Scope changes

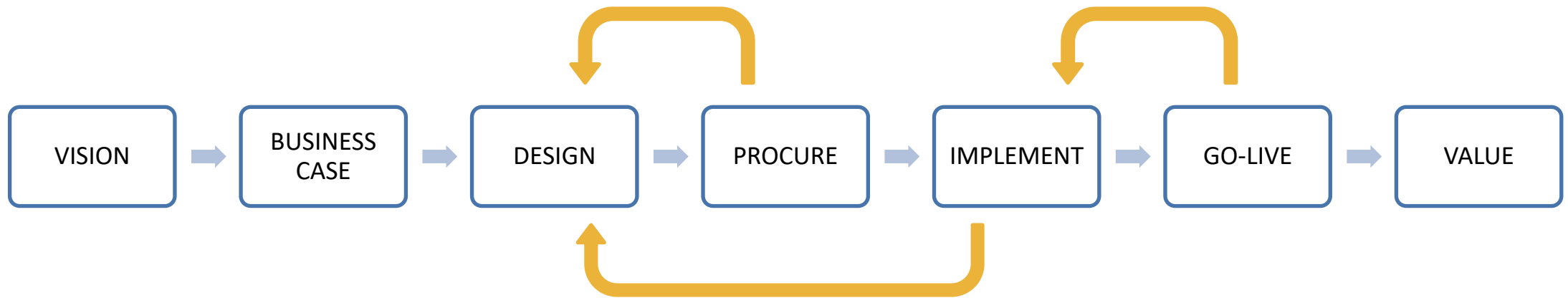
ROAD
CLOSED

DETOUR
→

START

The plan is linear.

Implementation isn't



Reality doesn't respect our arrows

Implementation is managed adaptation

Momentum matters

AMBITION

WINDOW OF OPPORTUNITY

ACTION



Good ideas don't automatically create projects

When the window opens, be ready to move

Scope has gravity

2017 — THE ORIGINAL IDEA



UNIT DOSE → BEDSIDE SCANNING

A relatively simple idea

New opportunities **come with** **new requirements**



NEW HOSPITAL
DIGITALISATION
LEGISLATION
New possibilities



EXTERNAL FUNDING
The window opened



FUNDING REQUIREMENTS
*End-to-end medication
management
Interoperability*

The opportunity enabled the project
The requirements expanded it

And technology **moved too**



A new standard. Multiple vendors

Almost no practical experience

Digital transformation **moves walls**



Don't fit the future into today's space

Create the space the future needs

**Every addition made
sense**

**Together, they
changed the project**

Stakeholders change

And so does their influence



Stakeholder management isn't a one-time exercise

The map changes throughout the journey

Everyone owns a piece

Who owns the outcome?



Local success $\neq$ system success

The end-to-end journey needs clear ownership

**Go-live is only
halftime**

**Installation gets you
to go-live. Adoption
gets you to value.**

Installed $\neq$ Used $\neq$ Value



Installed is not the same as implementation success

And implementation success is not yet value

Did it **actually** get better?



If we don't measure, we don't know

Experience becomes evidence when we measure it

Design **before** you buy



Don't automate today's workflow

Design tomorrow's

Implementation is managed adaptation



Adaptation is not failure of the plan

Adaptation is part of the plan

FROM GUIDANCE TO REALITY

The Guide gives us the questions
Reality forces us to answer them

The perfect plan doesn't exist
Being ready to adapt does



Dr Daniele Bellavia

Research Associate

LIUC University



RESEARCH & APPLICATIONS
FOR BUSINESS



The impact of automation in hospital pharmaceutical logistics management: economic analysis in Europe

Daniele Bellavia
LIUC University, Italy

The value of innovation

- Healthcare is undergoing a phase of profound transformation: digitization and automation are increasingly present in clinical and organizational processes,
- These technologies promise greater safety, efficiency, and quality of care, but are often seen only as an additional cost,
- Focusing solely on the purchase price of a device is limiting: it means not understanding its overall impact,
- Each innovation changes workflows, staff organization, and resource utilization,
- It is therefore necessary to shift attention from a "cost" logic to a vision of strategic investment, capable of generating economic and organizational benefits in the medium and long term,

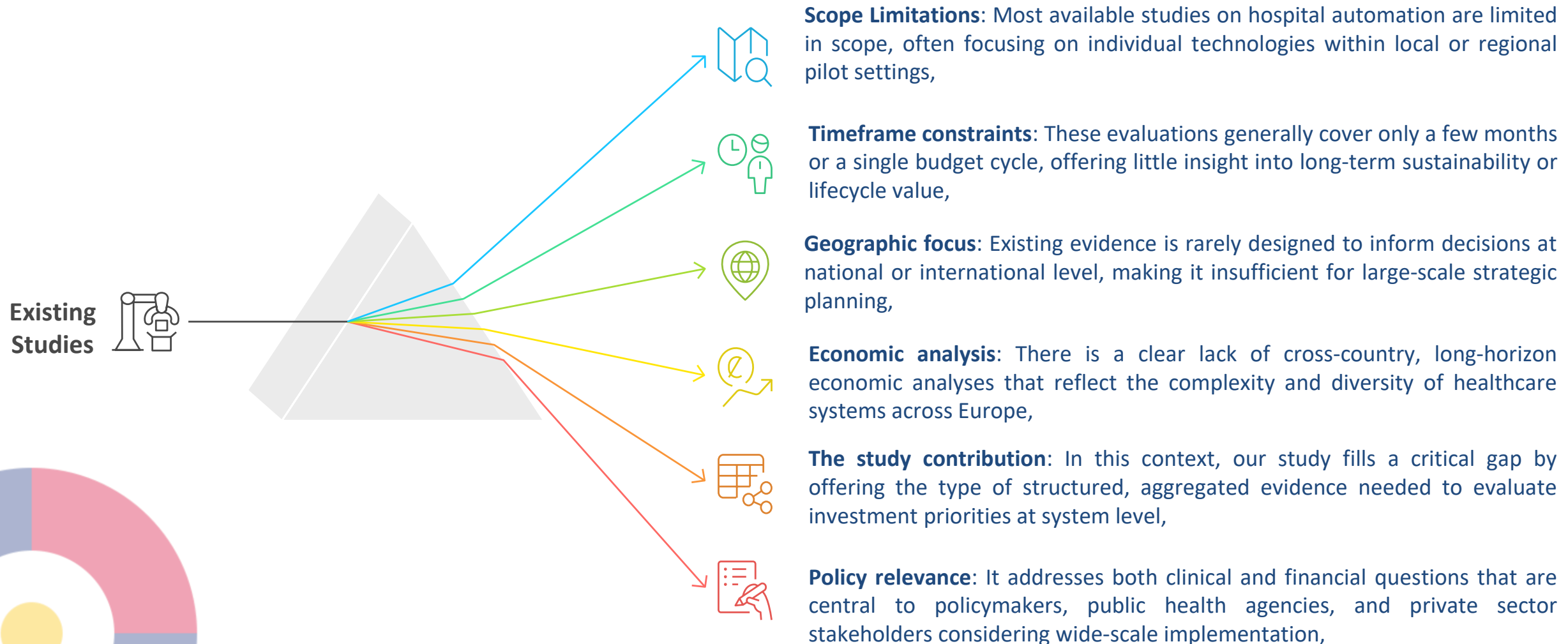


Automation in Europe

- In European hospitals, up to **0,1% of all doses** are affected by **medication errors**, leading to longer hospital stays and **higher costs**
- Studies prove that **automation reduces errors** by 50–100%, depending on the technology
- European healthcare systems are **increasingly adopting automation** and digital solutions to improve efficiency and safety in medication management,
- Despite this growing interest, adoption remains **limited due to high upfront costs** and the complexity of integrating new technologies into existing hospital infrastructures,
- A major barrier is the **lack of robust, large-scale economic evidence** demonstrating return on investment,
- The **EU Regulation 2021/2282 on Health Technology Assessment (HTA)**, fully enforced as of January 2025, calls for **stronger economic data** to support **investment** decisions in health technologies,



State of the art



From an expense... to an investment

- The introduction of new technologies in the healthcare sector requires significant initial investments, which often generate resistance from healthcare management and decision-makers,
- Without proper economic analysis, the technology risks being seen solely as a burden on the budget and not as an opportunity for improvement,
- A precise evaluation allows to demonstrate:

Which costs are reduced
errors, time, waste,
duplications

What benefits emerge
patient safety, organizational
efficiency, freeing up human
resources

What economic and
organizational return is
expected in the medium to
long term?

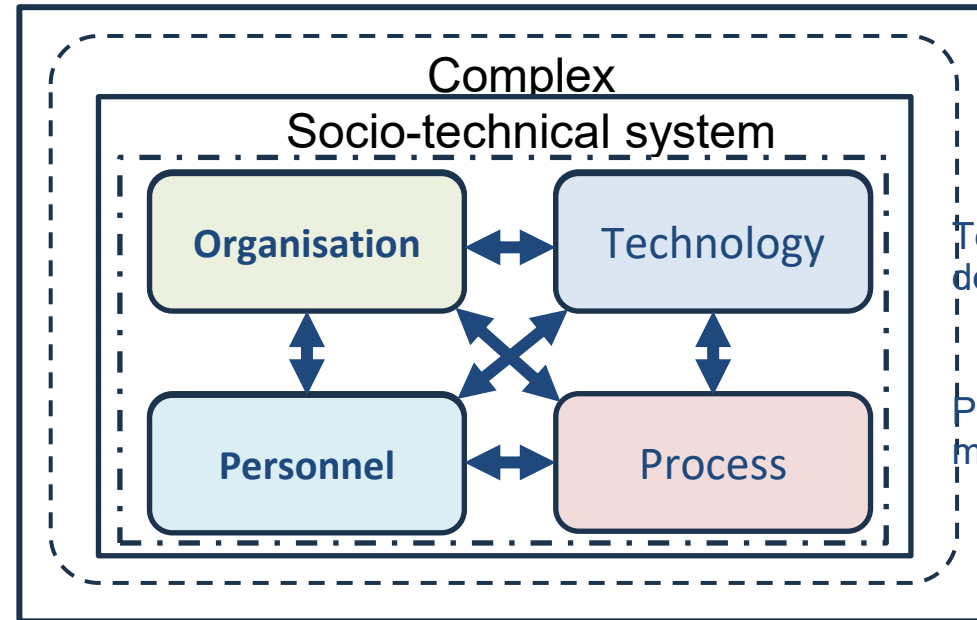
Providing solid and comparable evidence is essential to convince stakeholders and decision-makers that innovation is not only sustainable but can become a strategic investment,

Technology, organization, and process

Each hospital can be considered a socio-technical system, in which coexist and interact:

Organisation → governance models, distribution of responsibilities, decision-making processes

Personnel → skills, professional roles, workloads

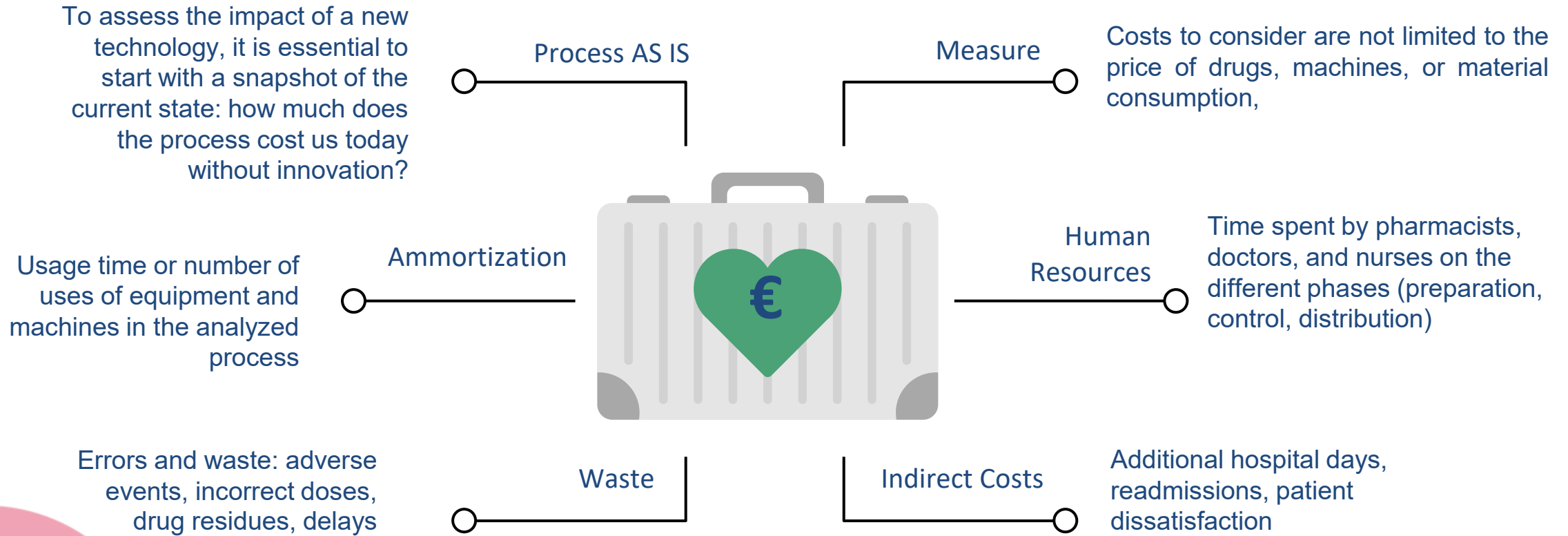


Technology → digital and automated tools, devices, infrastructures

Process → operational flows, work procedures, modes of interaction between departments

- These components are interdependent: modifying one inevitably influences the others,
- The introduction of a new technology is therefore not a neutral act: it changes the daily work of staff (new skills, different timing), requires organizational adjustments (who does what, with what responsibilities),
- It transforms clinical and logistical processes, redefining flows and priorities,
- That is why the impact is not only technological but also economic and organizational, and must be evaluated as a whole,

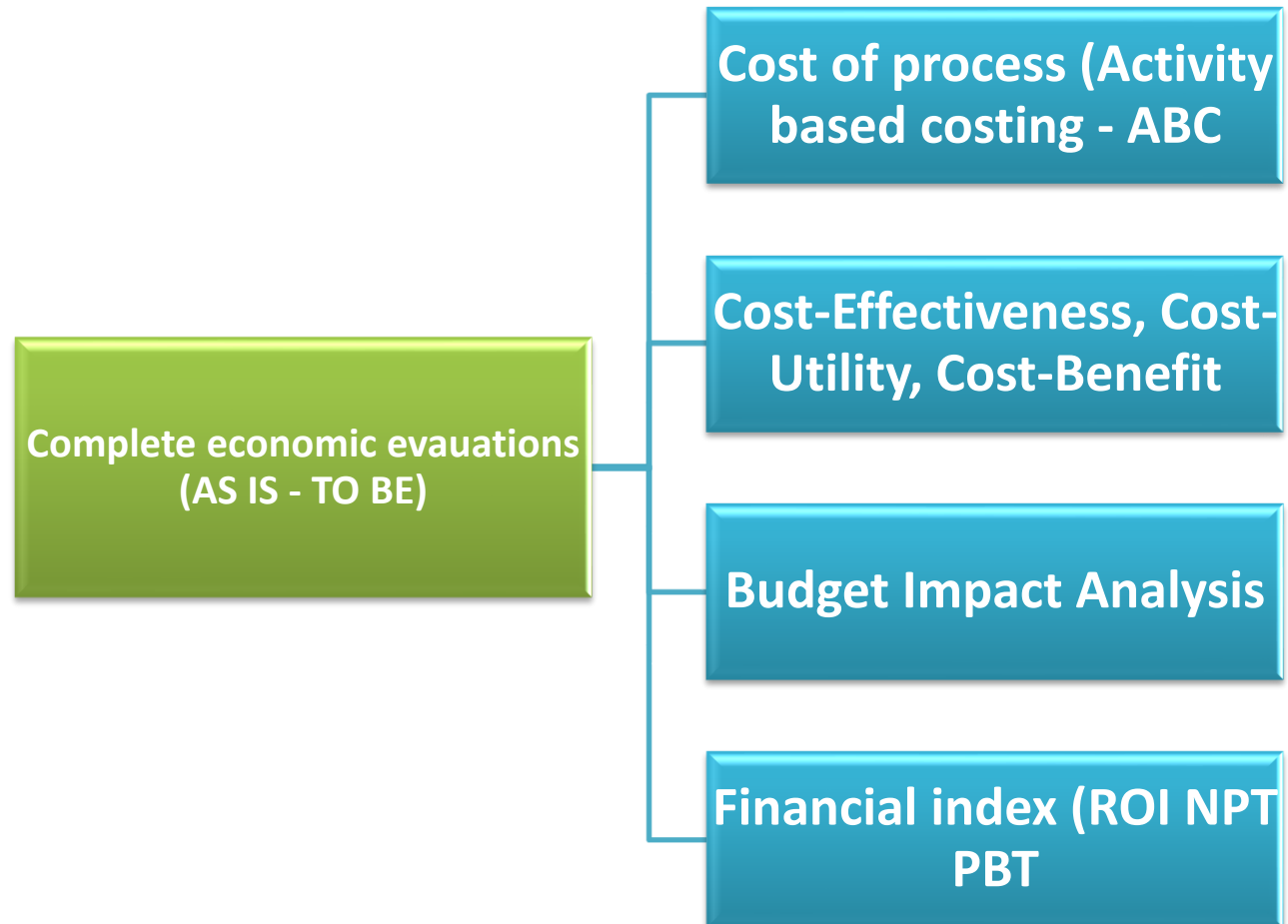
How much does a process cost?



Only with this mapping is it possible to understand where technology truly has an impact: it does not replace a single step, but often redesigns the entire workflow,

Economic Evaluation Methodologies

All techniques measure costs in monetary terms; the difference lies in the evaluation of the consequences,



ROI, NPV and PBT

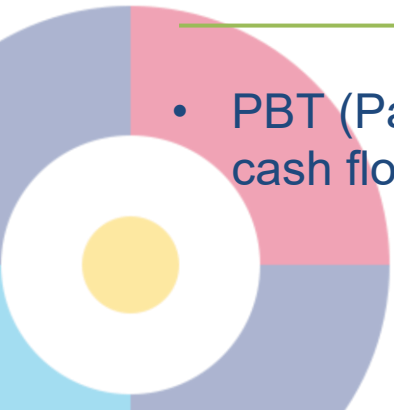
- ROI (Return on Investment): indicates the profitability of an investment by calculating the relationship between net profit generated and capital invested,

$$\text{ROI} = \frac{(\text{Total Costs} - \text{Total Savings})}{\text{Total costs}}$$

- NPV (Net Present Value): measures the net present value of future cash flows generated by an investment, discounted at the required interest rate, A positive NPV indicates economic viability,

$$\sum_{t=2024}^{2034} \frac{\text{Net Cash Flow}}{(1 + \text{inflation rate})^t}$$

- PBT (Payback Time): represents the time needed to recover the initial investment through generated cash flows, without considering the time value of money,



Results of the European study on investment in health technologies for medication management



healthcare



Article

The Impact of Automation and Digitalization in Hospital Medication Management: Economic Analysis in the European Countries

Federico Filippo Orsini, Daniele Bellavia , Fabrizio Schettini * and Emanuela Foglia 

Healthcare Datascience LAB, LIUC—Università Carlo Cattaneo, 21053 Castellanza, Italy; forsini@liuc.it (F.F.O.);

dbellavia@liuc.it (D.B.); efoglia@liuc.it (E.F.)

* Correspondence: fschettini@liuc.it



Objective



Actionable Evidence

The study aimed to assess the economic and organizational impact of medication management automation across Europe,



Financial Sustainability

Assessed long-term investment viability



Standardized Hospital Model

Adopted a standardized hospital dimension for a comparison across Nations



27 EU Countries plus UK

The analysis covered all **27 EU countries plus the UK**, using a standardized hospital model to ensure comparability,



Five Key Technologies

It evaluated **five key technologies** implemented in **acute care hospitals** over a **10-year period** (2024–2034),

The goal was to provide actionable evidence to hospital managers and policymakers on the long-term financial sustainability of these investments,

Technologies under assessment



Inventory Robot – Automates storage and retrieval in the central pharmacy; improves stock control and reduces picking errors,



Unit Dose System (UDDS) – Prepares individually packaged doses for each patient; enhances traceability and reduces preparation errors,



Automated Dispensing Cabinets (ADCs) – Secure ward-based cabinets; enable on-demand access to medicines with real-time documentation,



Smart Infusion Pumps with Dose Error Reduction System (DERS) – Standardizes infusion parameters in ICUs; prevents dosage mistakes,



Oncology Medication Traceability Platform – Tracks the entire chemotherapy process (prescription → preparation → administration); ensures safety in high-risk therapies,

Methodology

The analysis was built around a standardized model of a **561-bed acute care hospital**, representative of the average facility size across EU countries

Initial investment and operational savings were estimated using **country-specific data**

Results were then **scaled to the national level** based on the number of hospital beds and adjusted for **current technology penetration** in each country

A **sensitivity analysis** tested model robustness by simulating variations in hospital size and discount rates

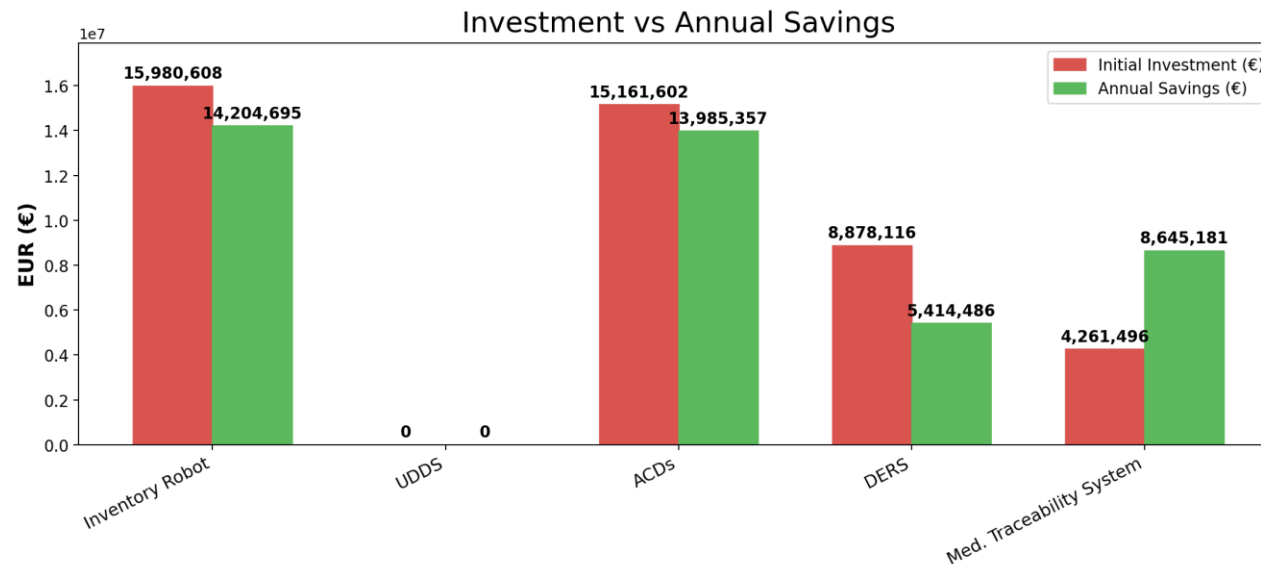
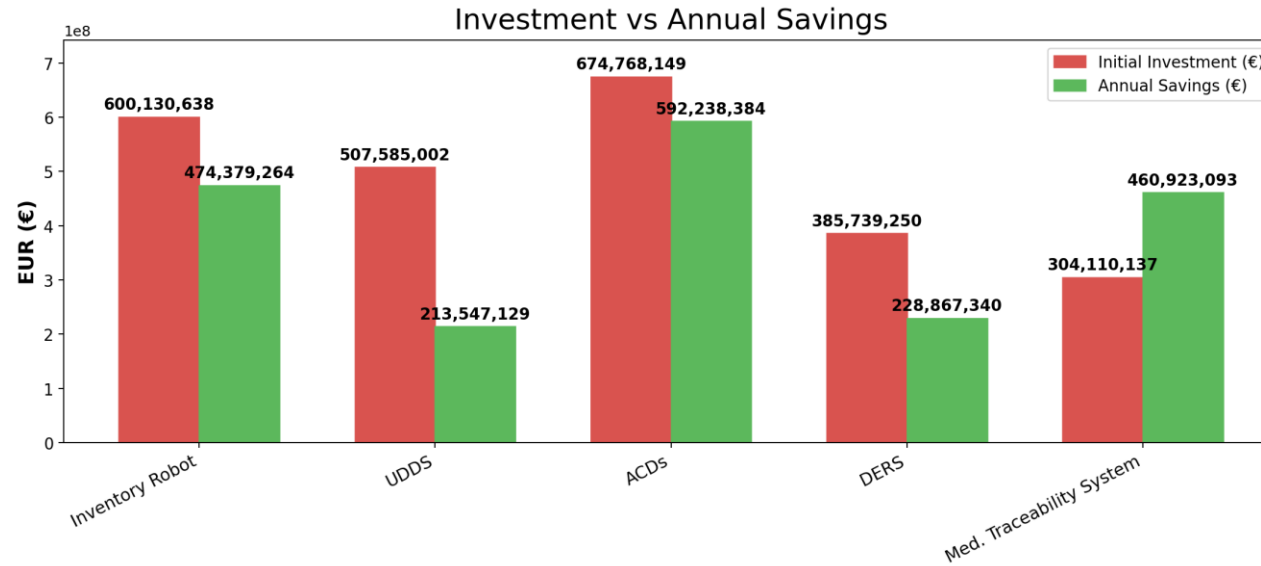


Methodology

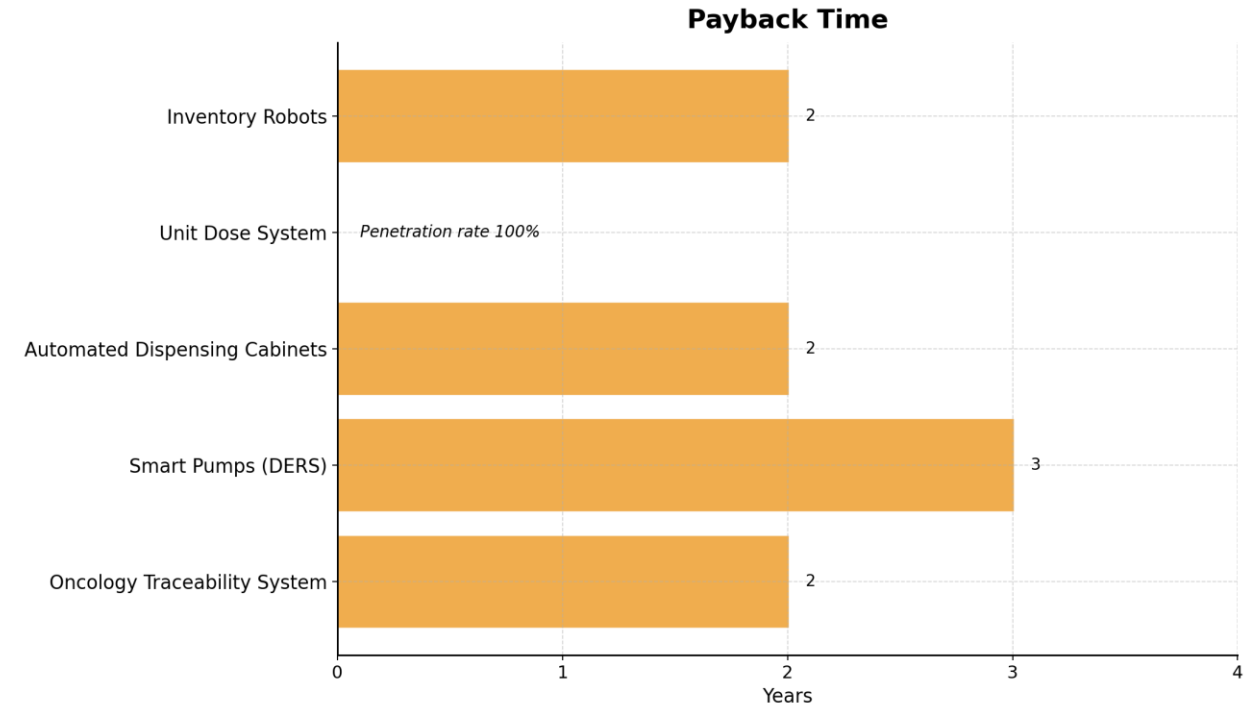
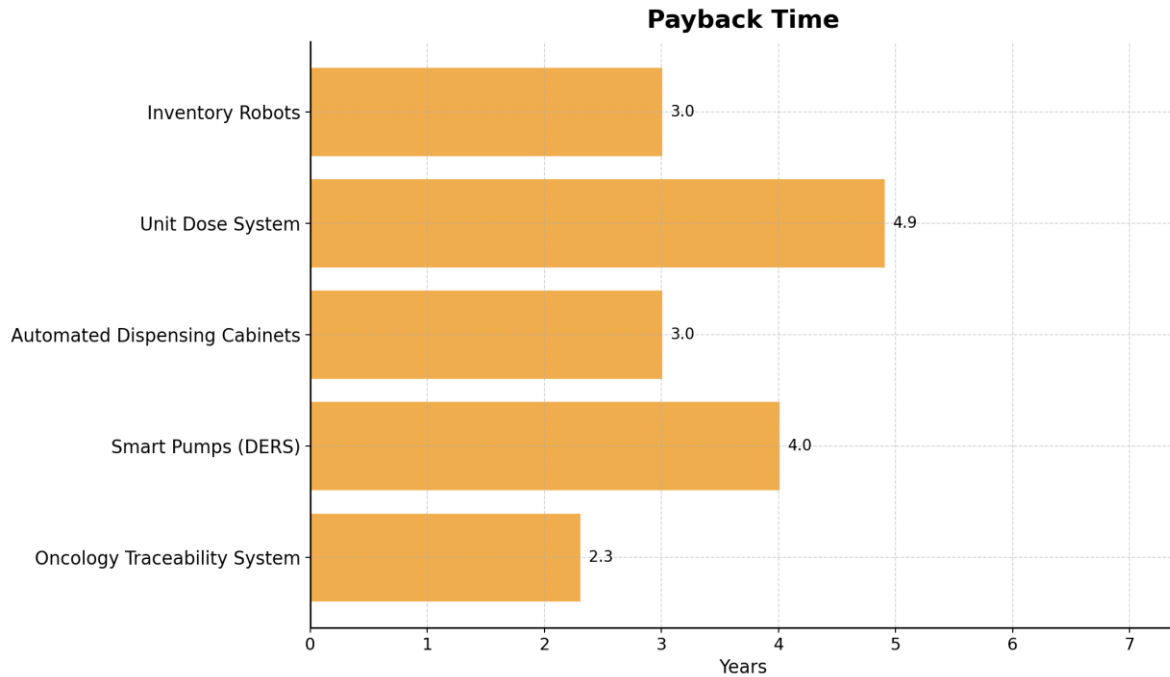
The clinical and organizational benefits of automation technologies were identified from the scientific literature, then valued using the Activity-Based Costing (ABC) technique, by estimating the time and resources saved at each phase of the medication cycle,

Technologies	Reduction of wasted medications	Stock reduction	Reduction of medication errors	Reduction of processing time
Inventory robots	–100% (Ahtiainen et al., 2020)	–26,4% (Giménez et al., 2019)	–16 % (Franklin et al., 2007)	–31,4% (technicians) (Ahtiainen et al., 2020)
Unit Dose System (UDDS)	–100 % (Herrmann et al., 2024)	0 % (supposed)	–53 % (Berdot et al., 2016)	–5,8% (nurses) / –10% (technicians) (Herrmann et al., 2024)
Automated Cabinets (ADC)	–100 % (Cousein et al., 2014)	–60,6% (Chen et al., 2022)	–53 % (Berdot et al., 2016)	–80% (nurses) / –50% (pharmacists) (Mathy et al., 2020)
Smart pumps with DERS	—	—	–100 % (Kastrup et al., 2012; Waterson & Bedner, 2019)	–69,8% (nurses) (Kastrup et al., 2012)
Oncological Traceability System	–100 % (Ferrario et al., 2020)	–21 % (Terkola et al., 2017)	–75–89 % (Reece et al., 2016; Sarfati et al., 2015; Aita et al., 2013)	–44% (pharmaceuticals) (Ferrario et al., 2020)

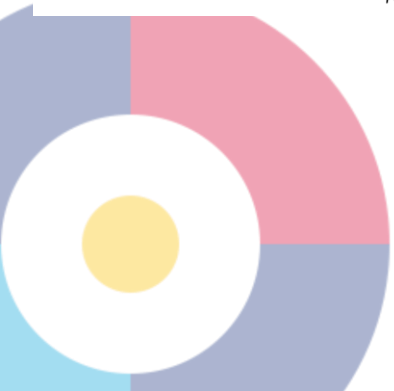
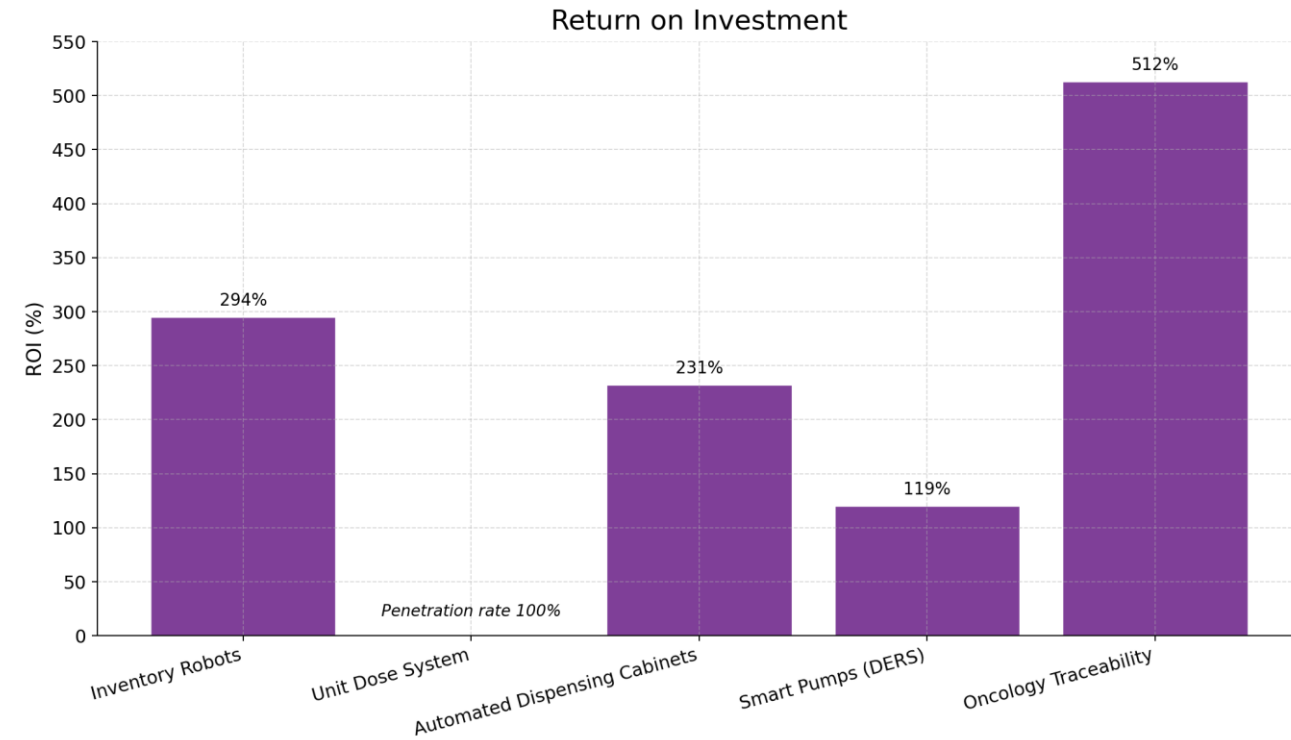
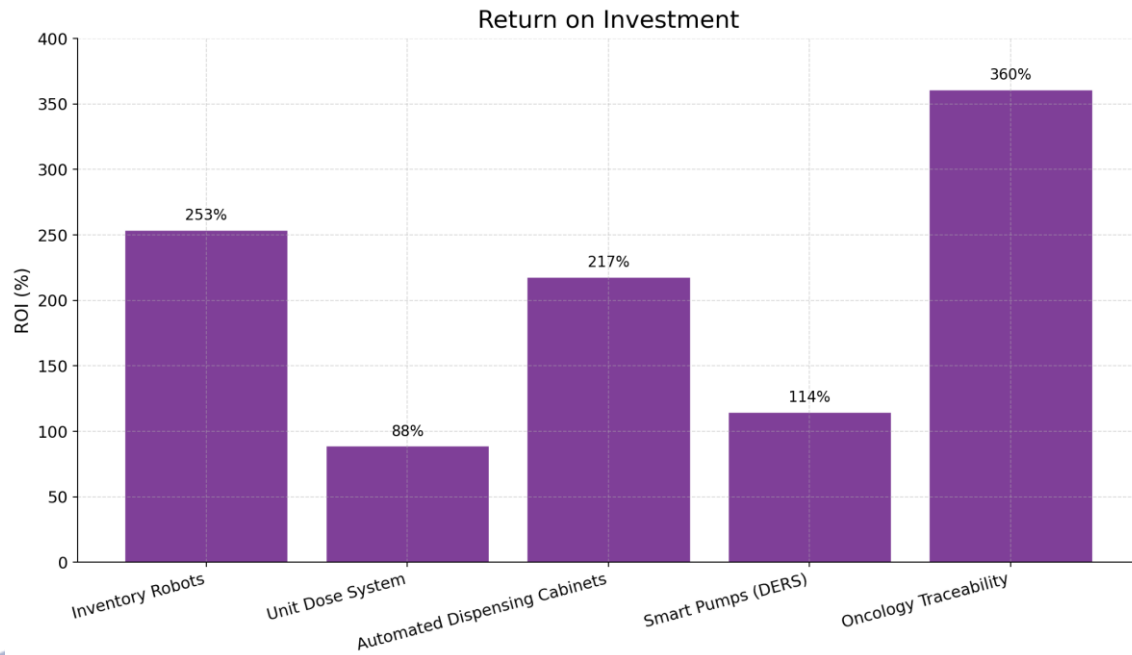
Investment and annual savings – 5 Technologies – Europe



Payback Time – France & Netherlands

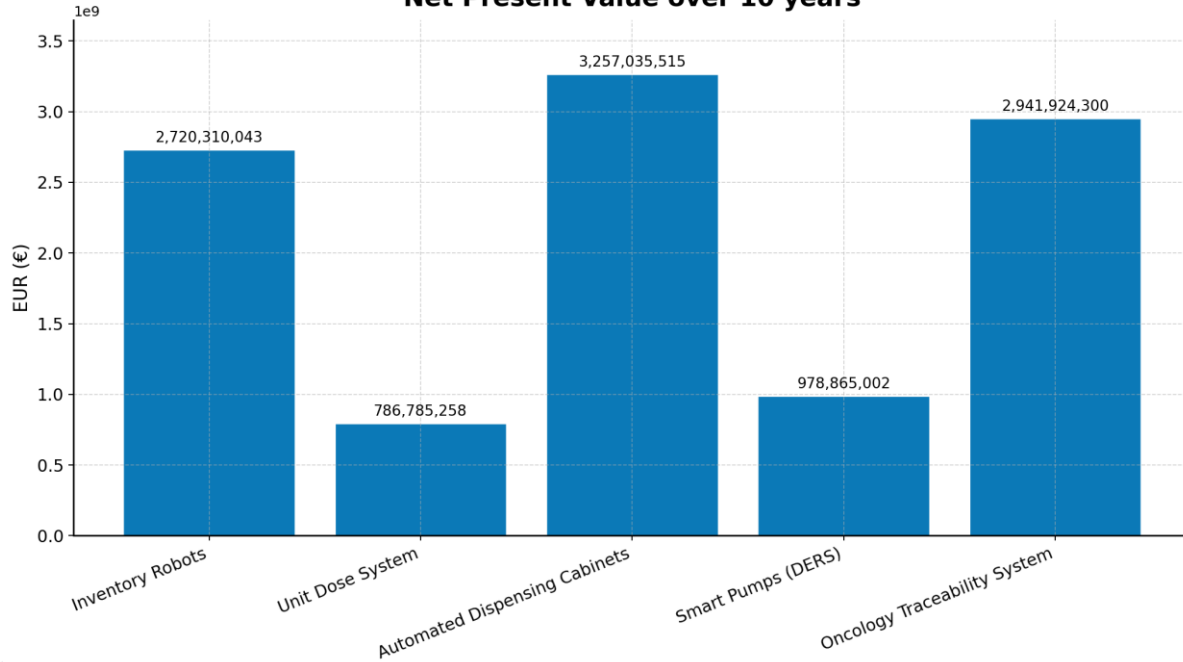


Return On Investment – 5 technologies

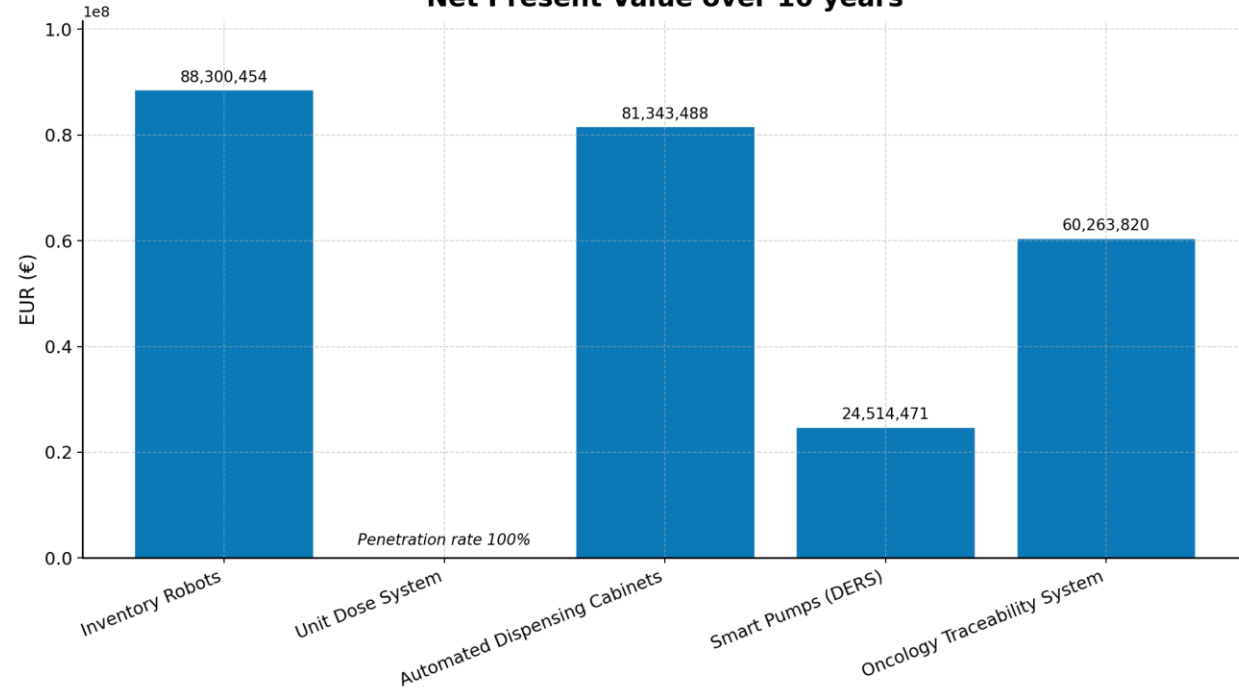


Net Present Value – France & Netherlands

Net Present Value over 10 years



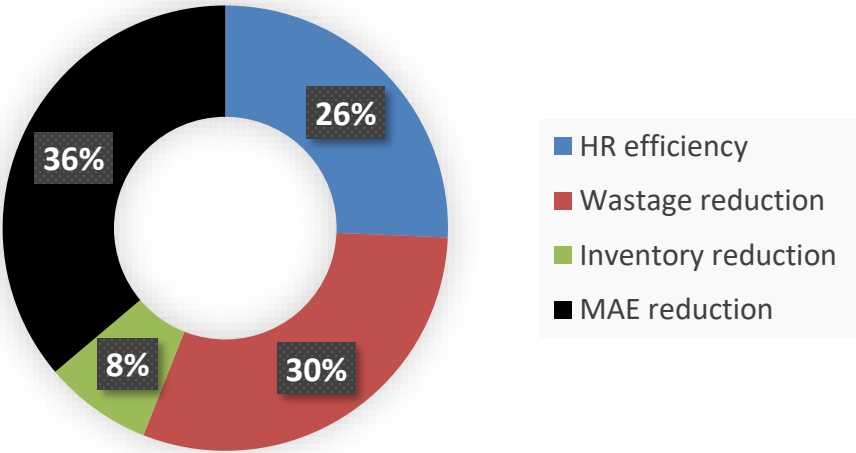
Net Present Value over 10 years



Savings Breakdown

	Netherlands (National)	HR efficiency savings	Waste reduction savings	Inventory reduction savings	MAE reduction savings	Total Annual savings
	Inventory Robots	4.057.855 €	8.210.314 €	1.694.320 €	242.206 €	14.204.695 €
	Unit Dose System	0 €	0 €	0 €	0 €	0 €
	ADCs	2.923.760 €	4.093.503 €	1.621.255 €	5.346.840 €	13.985.357 €
	DERS	712.312 €	0 €	0 €	4.702.174 €	5.414.486 €
	Traceability Onc.	3.150.739 €	506.865 €	0 €	4.987.577 €	8.645.181 €
	Total	10.844.665 €	12.810.681 €	3.315.575 €	15.278.797 €	42.249.718 €

Distribution of savings among cost drivers



Financial indicators - Europe



Level	NPV (€)	ROI	Payback Time (years)
Hospital	2,787,964	202%	3,4
Europe (27 EU + UK)	9,671,881,127 €		

Limitations and robustness

Standardized assumptions: the model uses an “average” 561-bed hospital and assumes homogeneous medication-use processes, Local variations in workflows (e.g., oncology protocols) may lead to different impacts,

Use of averages: country-level estimates rely on mean values for salaries, drug prices, and adoption rates; this introduces approximation and may not capture local heterogeneity,

Scaling up: extrapolation from hospital to national/EU level adds uncertainty, especially in smaller facilities or lower-GDP countries,

Sensitivity analysis: varying hospital size ($\pm 20\%$) and discount rate ($\pm 20\%$) confirmed the overall robustness: ROI and Payback remained stable



Conclusions

Financial Performance & Economic Viability (The ROI)

- **Predictable Value Creation:** Demonstrated **ROI over 200%**, with a consistently positive Net Present Value (NPV) across diverse healthcare settings,
- **Rapid Capital Recovery:** Initial investments achieve a full **payback 3 years or less**, proving financial viability even in resource-constrained environments,
- **Sustainable Resource Allocation:** High-fidelity economic modeling confirms that automation is not a cost, but a high-yield strategic investment

Clinical Excellence & Operational Impact (The Value)

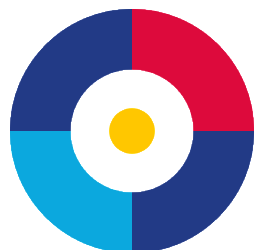
- **Immediate Safety Gains:** Transitioning to Closed-Loop Medicines Management drastically reduces medication errors and lowers the cognitive load on clinical staff.
- **Time Released Back to Care:** By streamlining workflows and optimizing stock, automation eliminates low-value tasks, allowing professionals to focus on patient outcomes.
- **Process Resilience:** Real-time interoperability and intelligent ward stock management reduce waste and ensure supply chain transparency.

Strategic Governance & Scalability (The Leadership)

- **HTA-Driven Decision Support:** The study provides a robust framework based on Health Technology Assessment (HTA) principles to guide clinical and economic sustainability.
- **Strategic Governance & Adoption:** > Success is driven by **rigorous HTA protocols** and **clinical ownership**. Impact is secured through a staged rollout that aligns technological capabilities with organizational maturity.
- **Universal Value Drivers:** Despite systemic differences across Europe, the core drivers—safety, efficiency, and waste reduction—are globally scalable and consistent.



RESEARCH & APPLICATIONS
FOR BUSINESS



Thank you!
[dbellavia@liuc.](mailto:dbellavia@liuc.it)
[it](mailto:dbellavia@liuc.it)

THANK YOU

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