

IMPLEMENTING DIGITAL MEDICATION MANAGEMENT IN HOSPITALS

3 September 2026



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 (20 minutes)

Presentation of our White Paper and Managers' Guide

Alexis Strader, Director of Policy and Research, EHMA

Expert reflections (20 minutes)

Practical implementation experiences from hospital settings

Francine de Stoppelaar, Co-Founder, The Asclepius Project

Q&A and discussion (10 minutes)

The business case for digitalisation (30 minutes)

Return on investment of digital medication management

Dr Daniele Bellavia, Research Associate, LIUC University

Hospital case study (30 minutes)

Digital transformation of medication management within a hospital merger.

Sofie Peeters, Chief Hospital Pharmacist, AZ Turnhout

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 



Francine de Stoppelaar

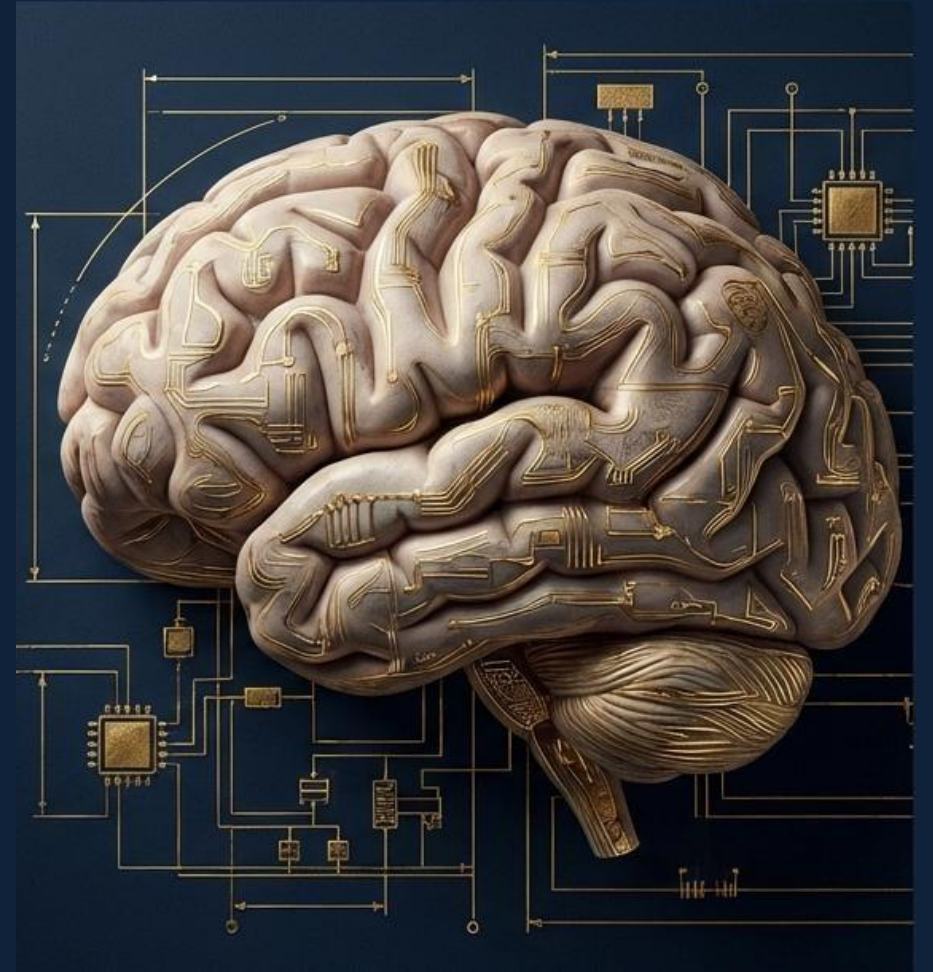
Co-Founder

The Asclepius Project

In Practice What works? What doesn't work?

Digital Transformation of Medication
Management in European Hospitals
and beyond...

Francine de Stoppelaar
PharmD, MSc, CertBA
Former Chief Pharmacist, Associate Professor



Stories



\$42 BILLION

The estimated global cost of medication errors

The unsustainability of manual medication logistics

181.626

Extra bed days
consumed by
avoidable adverse
drug events in
England annually

4 MILLION

Projected
healthcare worker
shortage in Europe
by 2030

300 MILLION

Spend on
medicines waste
annually in the UK



Call for Action

- **EHMA - How To Managers Guidebook**
- **EHMA - Digital Medication Management White Paper**
- **EDQM - Guidelines on the best practices for the traceability of medicines in hospital settings**
- **EAHP – several white and position papers**
- **The Asclepius Project – Story 4**



cybersecurity

strategy

continuous optimisation

pathway redesign

real-time data

end-to-end traceability

interoperability

change management

humanising

safety

sustainability

workforce

patient

shortages

embedded performance management

user experience

patient experience

agility

budget

efficiency

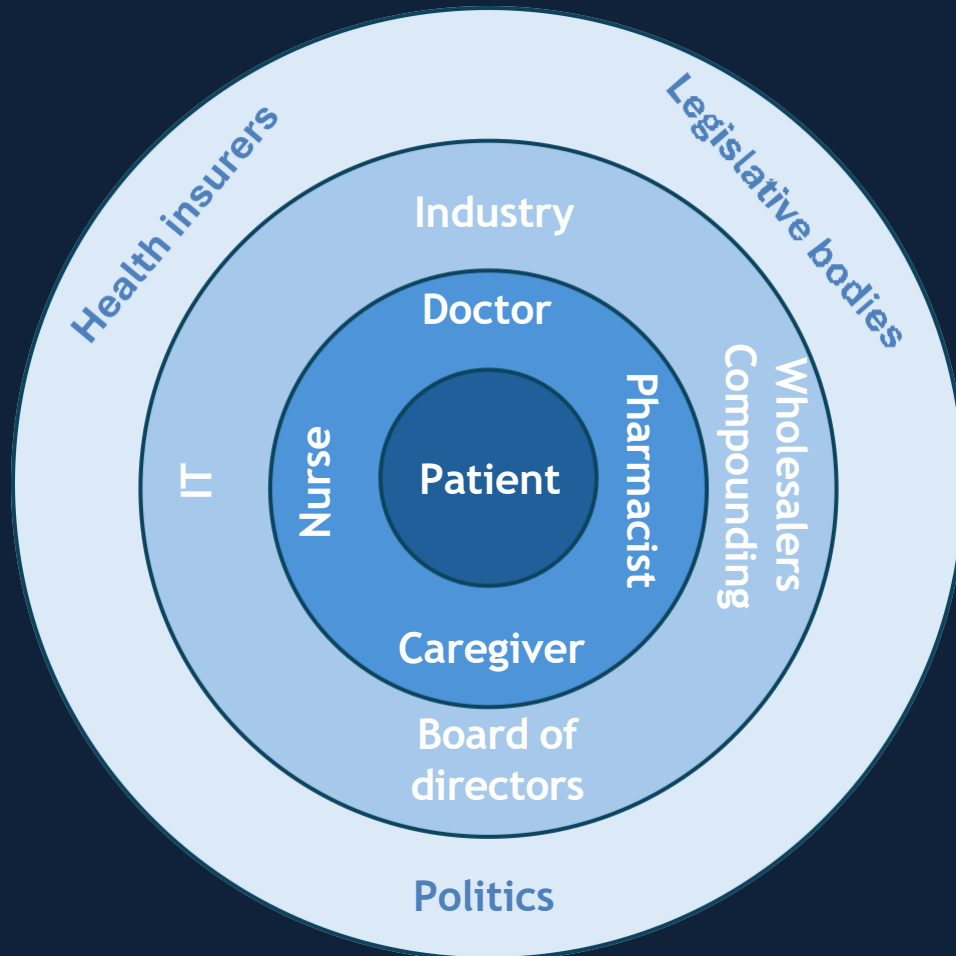
stakeholders

momentum

managing expectations

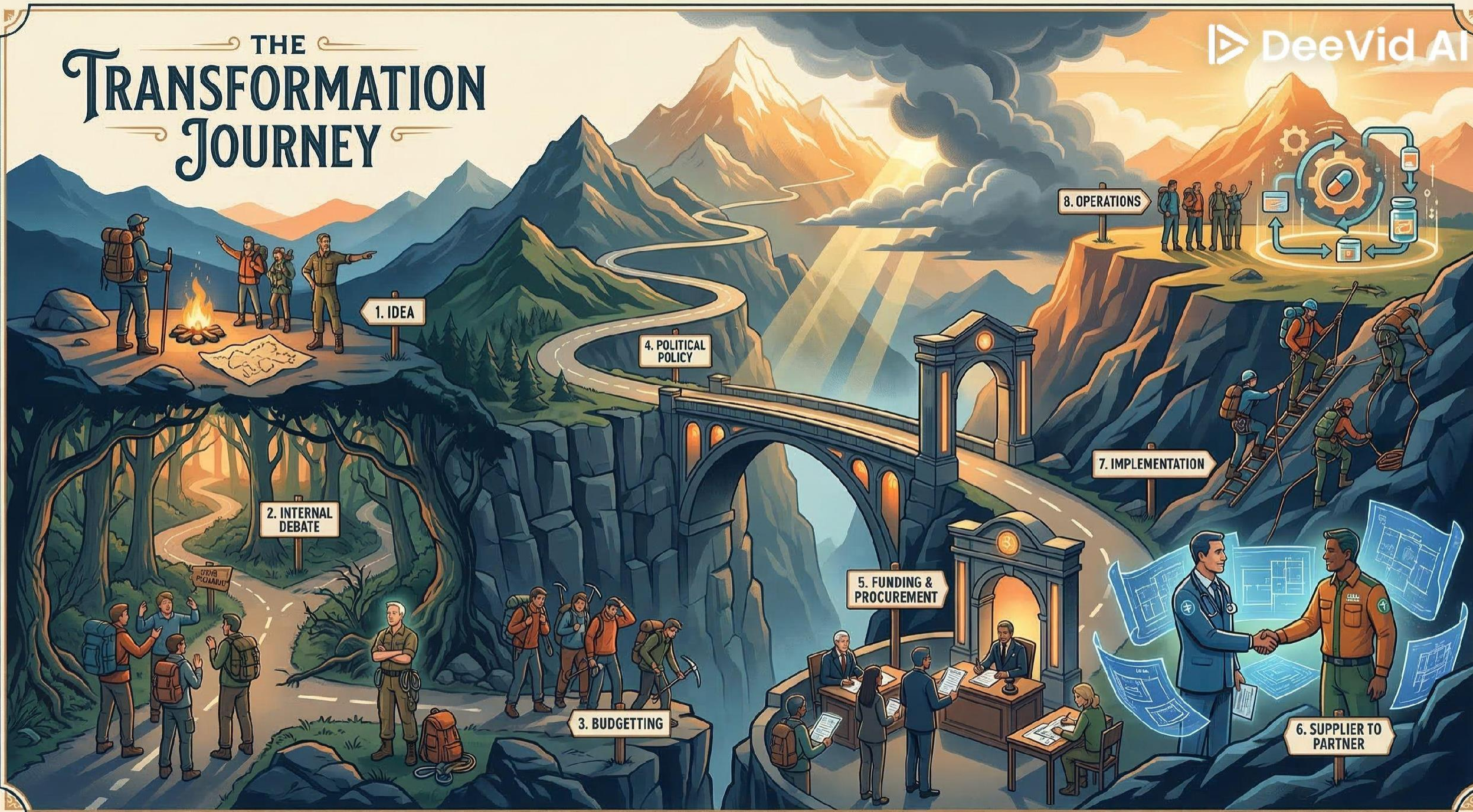
resilience
future vision

Digital Transformation Is a Stakeholder Puzzle



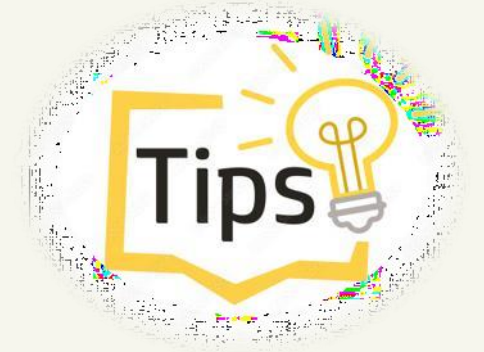
THE TRANSFORMATION JOURNEY

DeeVid AI



Transformation Journey Tips

Humanize the digital journey



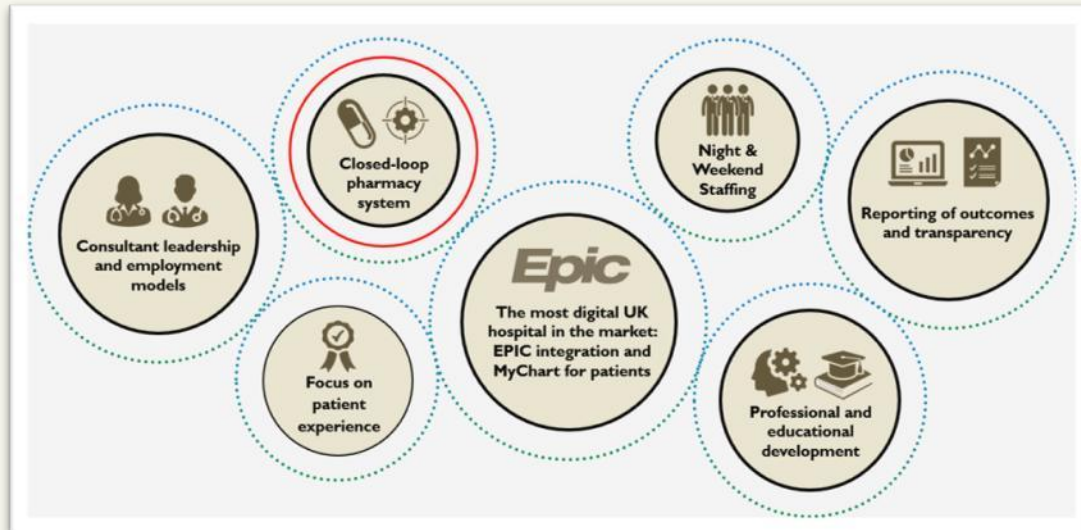
1. Ensure support from C suite leaders, both financially and strategically
2. Good governance is key, Leadership is key
3. Assess current workflows carefully, identify improvement opportunities and choose solutions that fit your needs
4. Do NOT simply copy your existing workflows into your digitalisation journey
5. Build strong relationships with partners and stakeholders – hand in hand, beginning to end
6. Continuously engage with employees, MDT approach; build trust, ample cheer leading
7. Train, train and re-train
8. Pause, take stock and ensure the right expertise and knowledge is in place to continue your journey – iterative approach
9. Expect setbacks and disappointments
10. Finally, perseverance, trust and courage are essential

Story 1

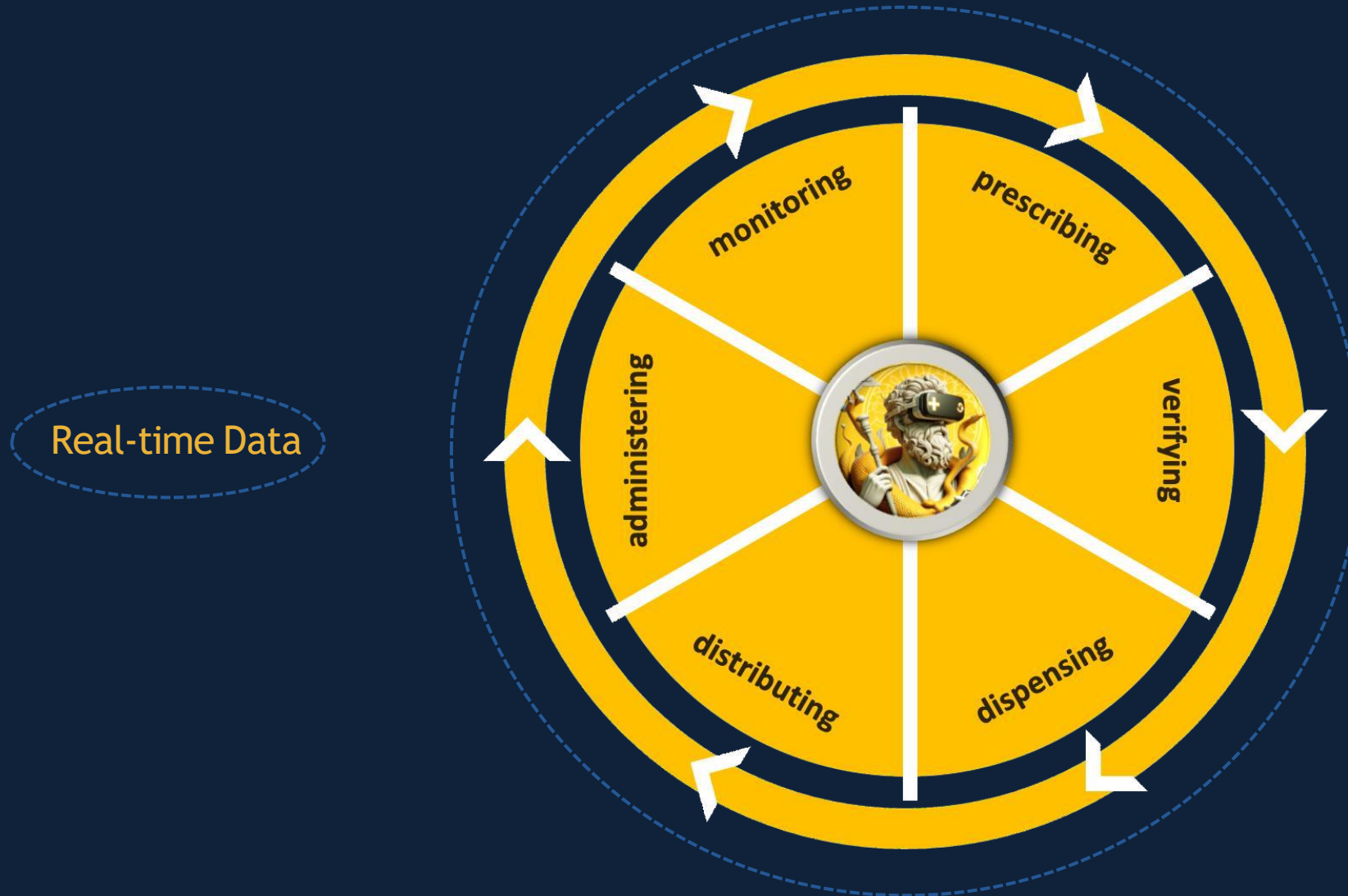
New Hospital

Unique and Innovative

- First fully digital hospital in UK
- Exceptionally complex surgeries
- Intraoperative MRI
- Most advanced Intensive Care
- Pharmacy Robotics to reduce bedside medication administration errors



Closed Loop Medication Management in Action



CLMM is not a machine you buy.

It is a strategic redesign of the entire medication system.

Patients First

10 other firsts

1. First in the UK to produce individually barcoded Unit Doses of all formulations, including Controlled Drugs
2. First in the UK to establish a Centre of Excellence for operating a unique Unit Dose Robot
3. First in the UK to use hospital wide Barcoded Medicines Administration (BCMA) at the bedside
4. First in the UK to implement complete CLMM on medicines management, fully digital and automated
5. First in the UK to operate Automated Dispensing Fridges hospital wide
6. First in the UK to operate Automated Dispensing Cabinets in Peri-Operative Environment
7. First in the UK to operate Automated, Integrated Carousels
8. First in the UK to produce all infusions by Pharmacy through a fully digital paperless aseptic production
9. First in the UK to run 24/7 Full Hospital Pharmacy Operations.
10. First in the UK to realize real time, instant pharmacist verification of all Inpatient prescriptions, at all times

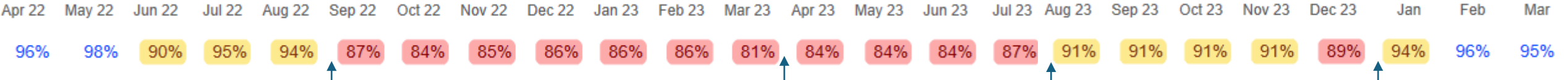
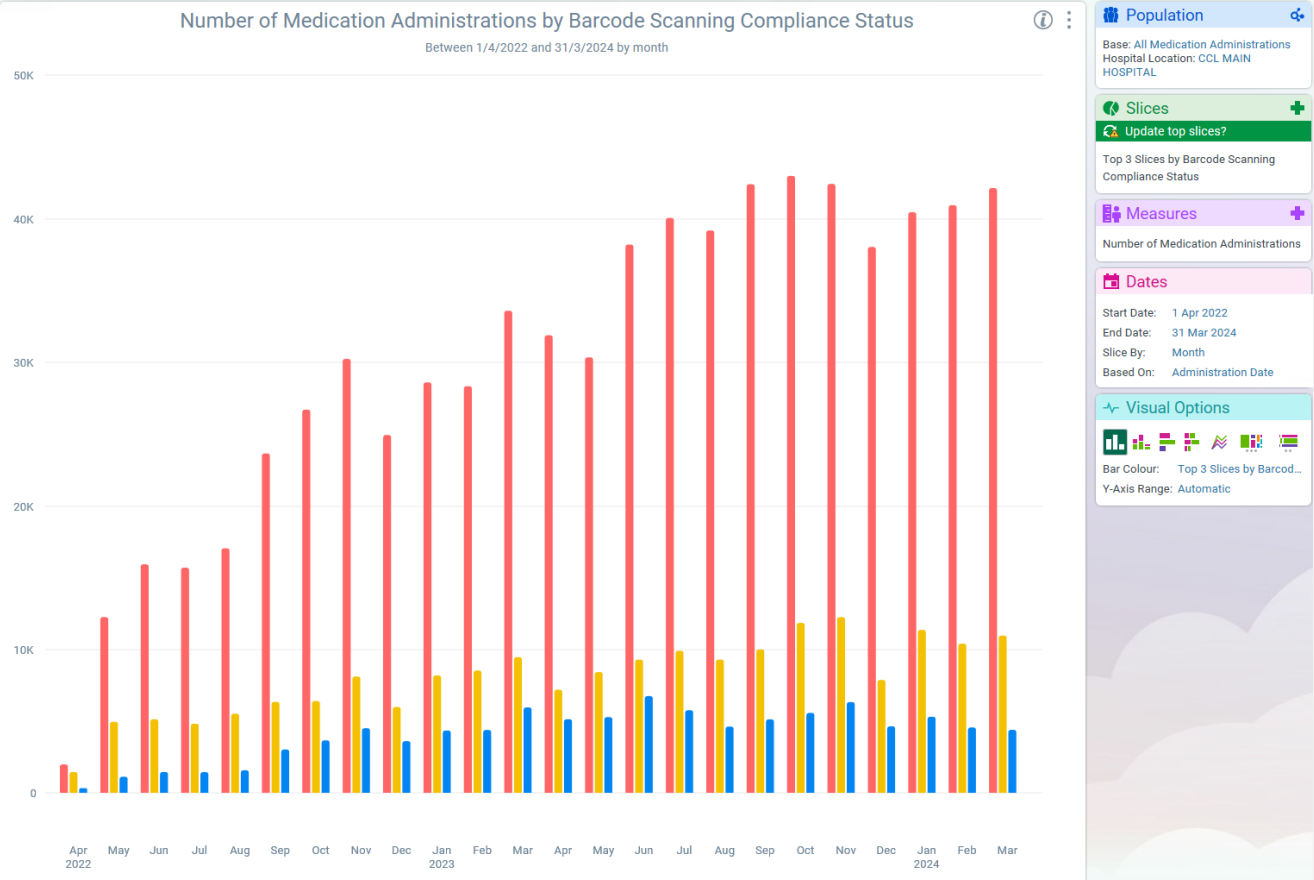
The Big Bang Go Live

6 years planning
and building

Go Live

Post
Go Live
Continuous
Improvement

BCMA Compliance



Significant ramp in patient volumes

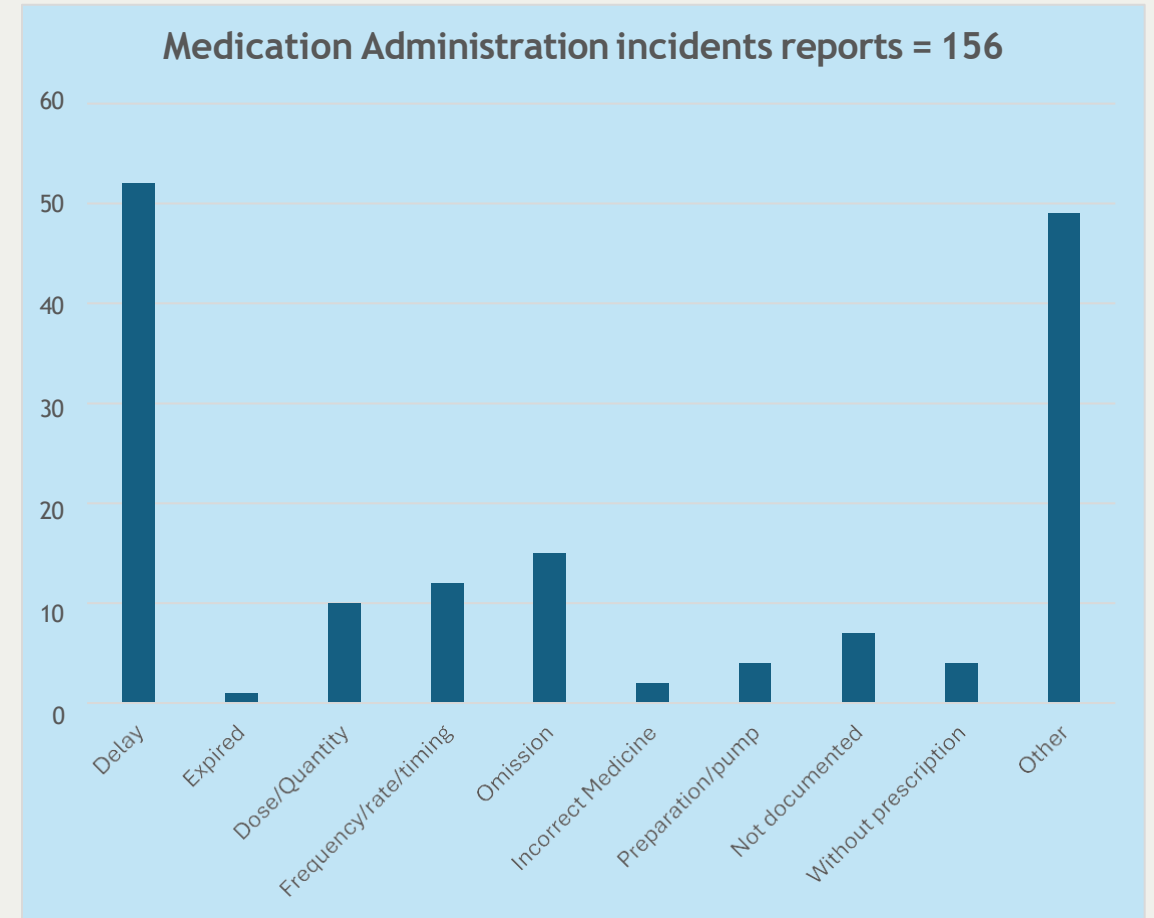
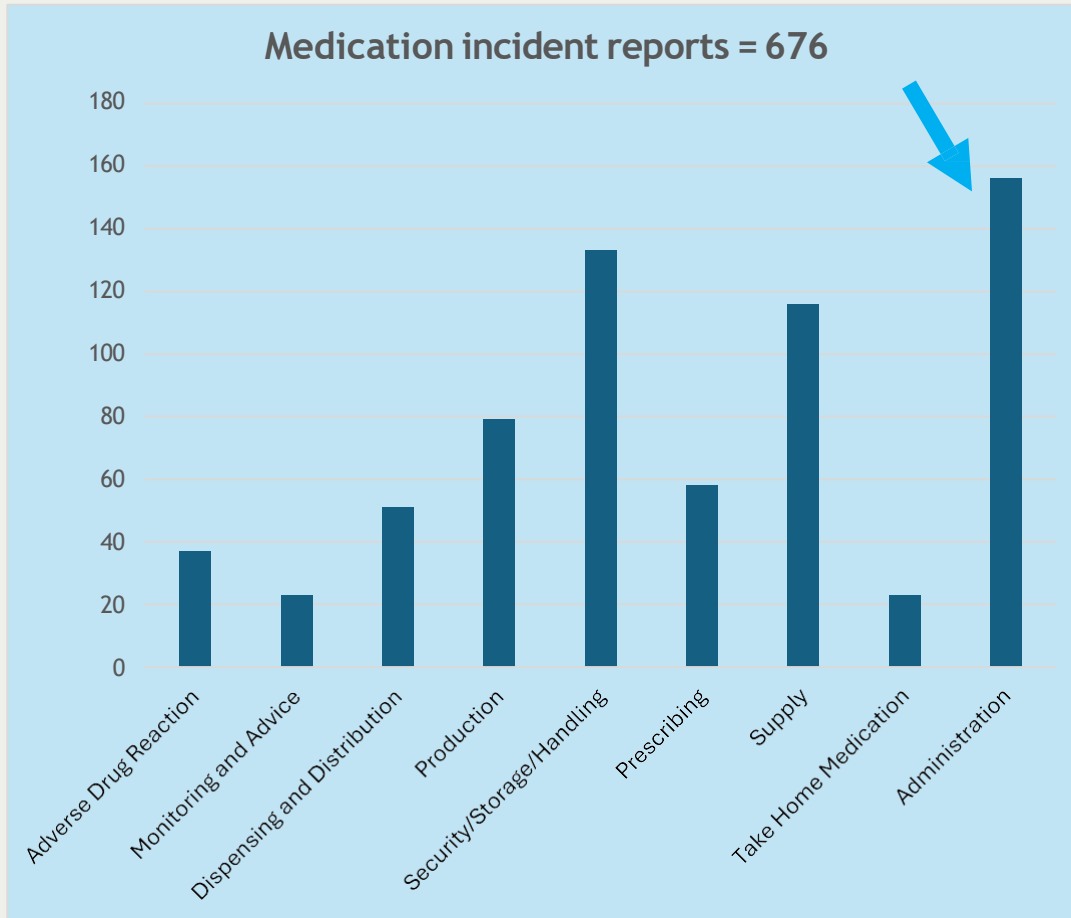
Awareness Campaign Commenced

Root Cause Analysis

Interventions Commenced

Medication incidents reports analysis

1st April 2022 – 1st April 2024

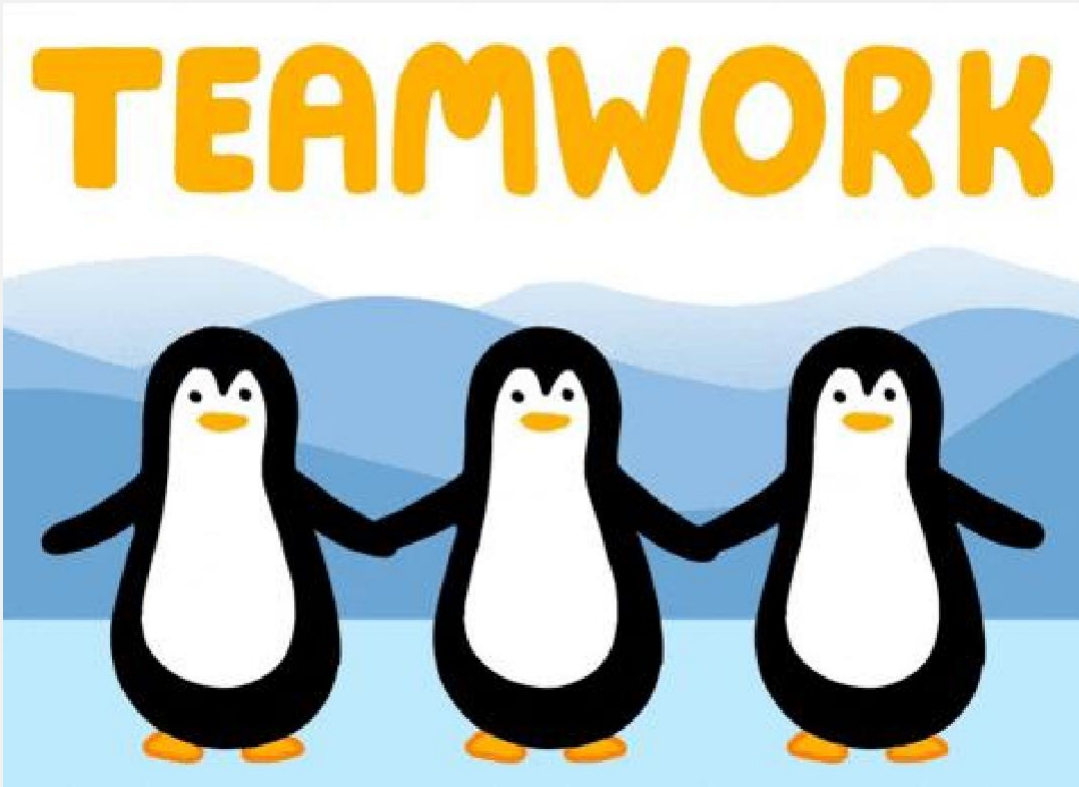


1,000,000 med administrations
1,000,000 med administrations
676 med incident reports

676 incident reports
156 admin incident reports
156 admin related

0.07% incident rate
0.0001% administration incident rate
23% of reports administration related

We did it... What happened afterwards?



- Skills: Pre-Go Live versus Post Go-Live
- When are you entering 'BAU'?
- Data: comprehensive accessible data – continuous, real time
- Near-zero medication errors
- HIMSS **EMRAM stage 7**
- Operational Efficiency: automated replenishments, redirecting workforce
- Staffing: 24/7 staffing significant challenge
- Some level of mundane tasks/deskilling
- EHR continuous optimisation
- Automation failure, resilience challenges
- Continuous Improvement challenges – 'after go live list' untouched

Story 2

40 new hospitals 11 by 2033



**small, mid-sized, major,
teaching, multi site**

**Hospital 2.0
Industrialisation
Intelligent Hospitals
Digital, Integrated, Patient Centred**

NHS 10-year Plan

- 1. From Sickness to Prevention**
- 2. From Hospital to Community**
- 3. From Analogue to Digital**

**Once-in-a-generation
opportunity**

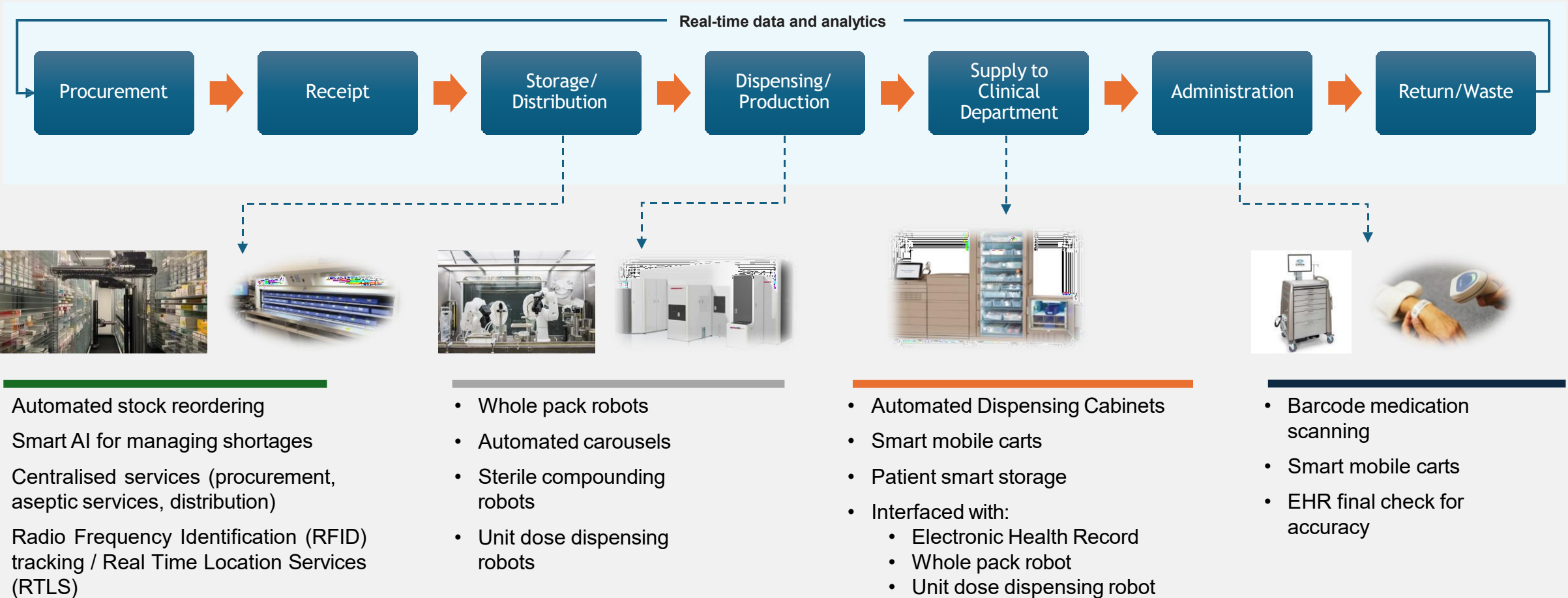
**Key Pillars: Safe, Effective,
Efficient, Sustainable**

Support, Guide, Engage

**Critical Thinking, Maturity
Assessment**

**Strategy, Vision, Guidance,
Business Cases, Roadmaps**

Technology Opportunities



Story 3

The Asclepius Project: Learning Across Europe



Collaboration as a catalyst for digital transformation

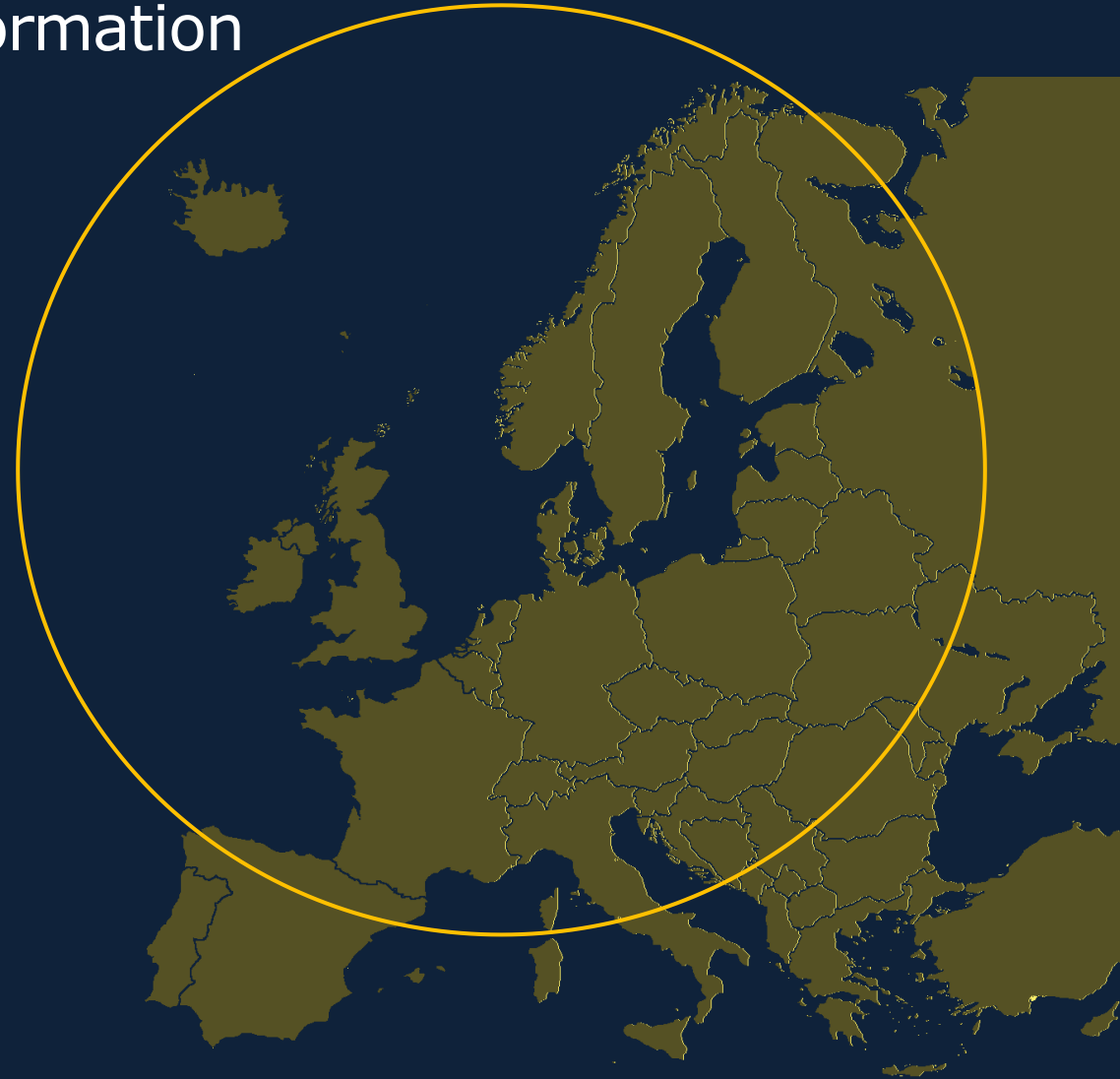
European collaboration driving acceleration of digital transformation of medicines management

- Tackling common challenges together
- Sharing lessons from real transformation journeys
- Developing practical specifications (e.g. interoperability)
- Building leadership skills and capabilities
- Peer-to-peer advisory and internal consultancy

Transformation journeys

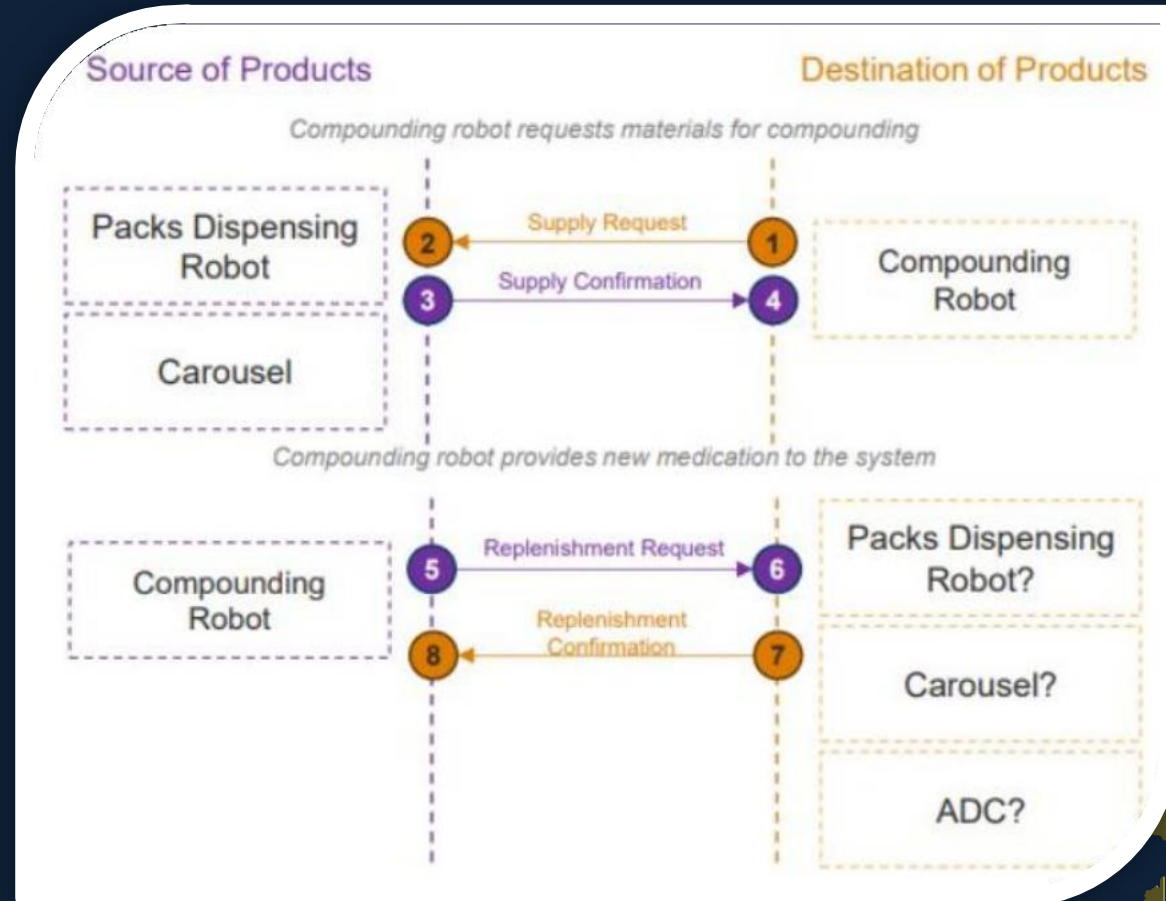
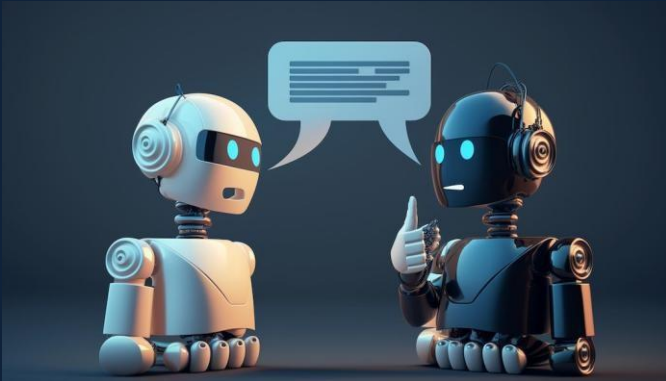


Similar lessons



Story 4

Special Interest Group on Interoperability



10 Keys to Transform

Takeaways that matter

Leadership

1. Secure C-suite sponsorship
2. Establish governance early

Process

3. Reinvent first, then automate
4. Never digitise a broken process

Collaboration

5. Build strong partnerships
6. Engage key stakeholders through multidisciplinary teamwork

Implementation

7. Invest in (re)training C support
8. Pause C review at key milestones
9. Expect setbacks
10. Persevere and Cheerlead



Thank you

@ Questions and Comms via EHMA



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,

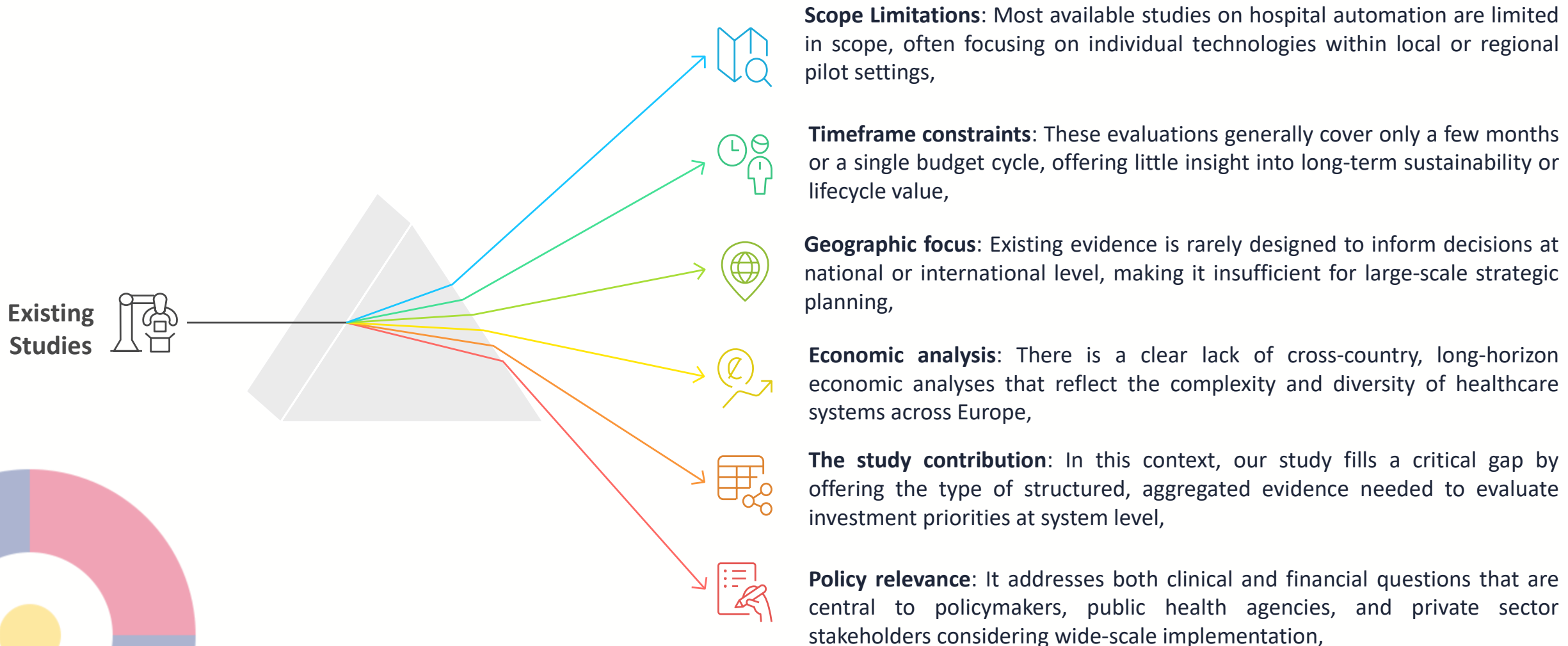


Automation in Europe

- 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?

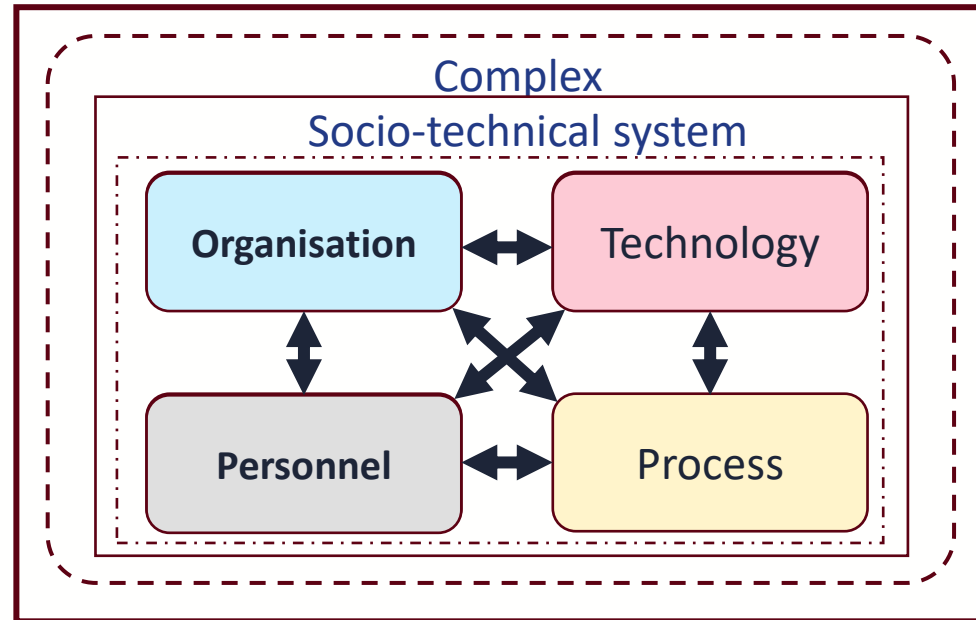
Providing solid and comparable evidence is essential to convince stakeholders and decision-makers that innovation is not only sustainable but can become a strategic investment,

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



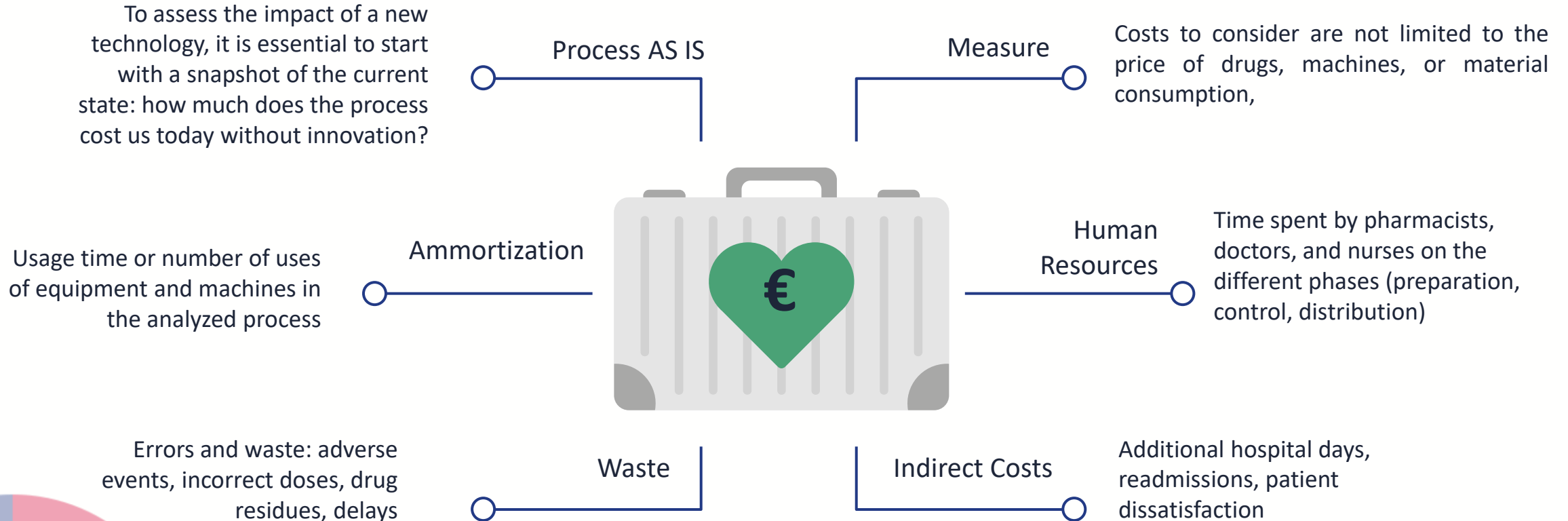
Technology → digital and automated tools, devices, infrastructures

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?

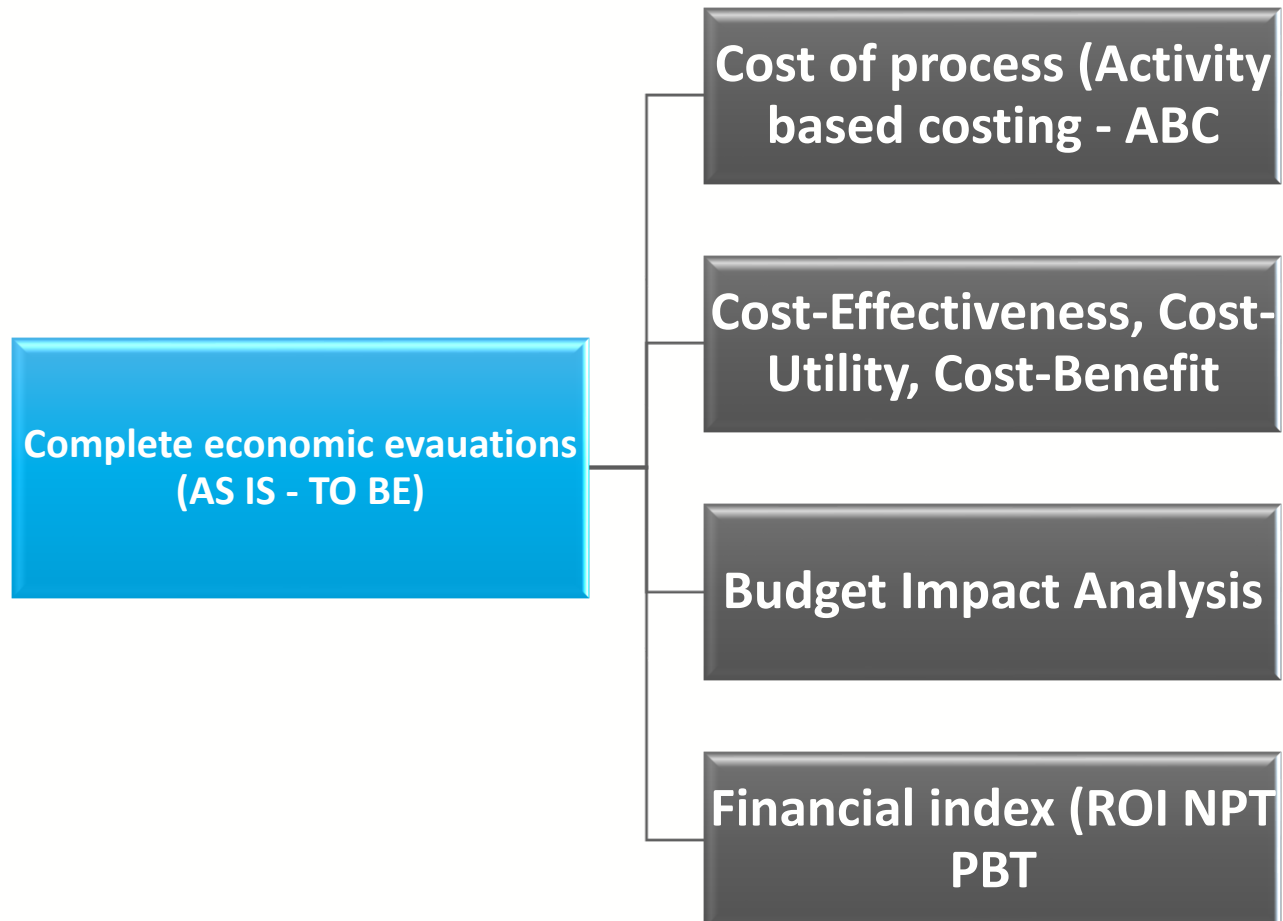
To assess the impact of a new technology, it is essential to start with a snapshot of the current state: how much does the process cost us today without innovation?



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

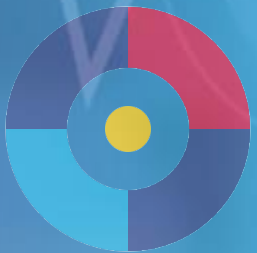
The Impact of Automation and Digitalization in Hospital Medication Management: Economic Analysis in the European Countries

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,

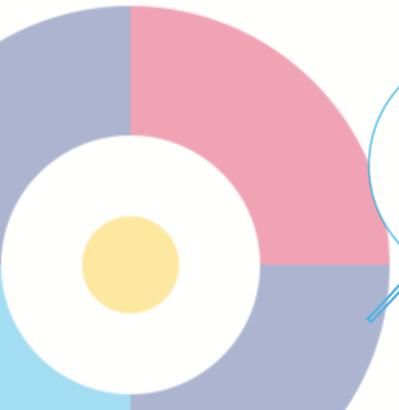
Methodology

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

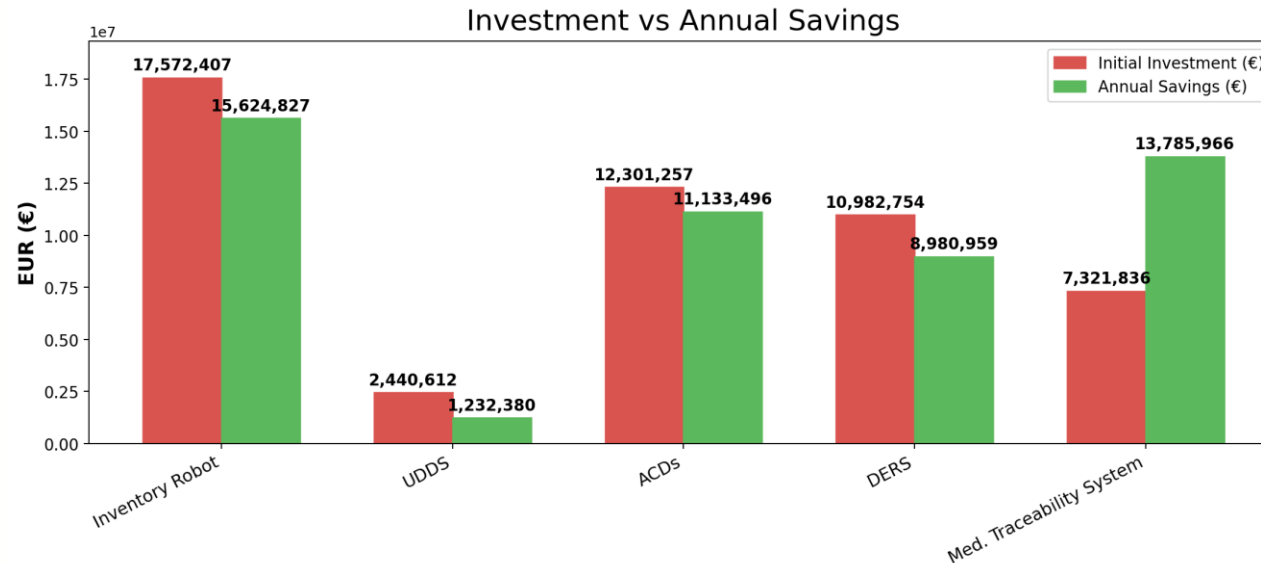
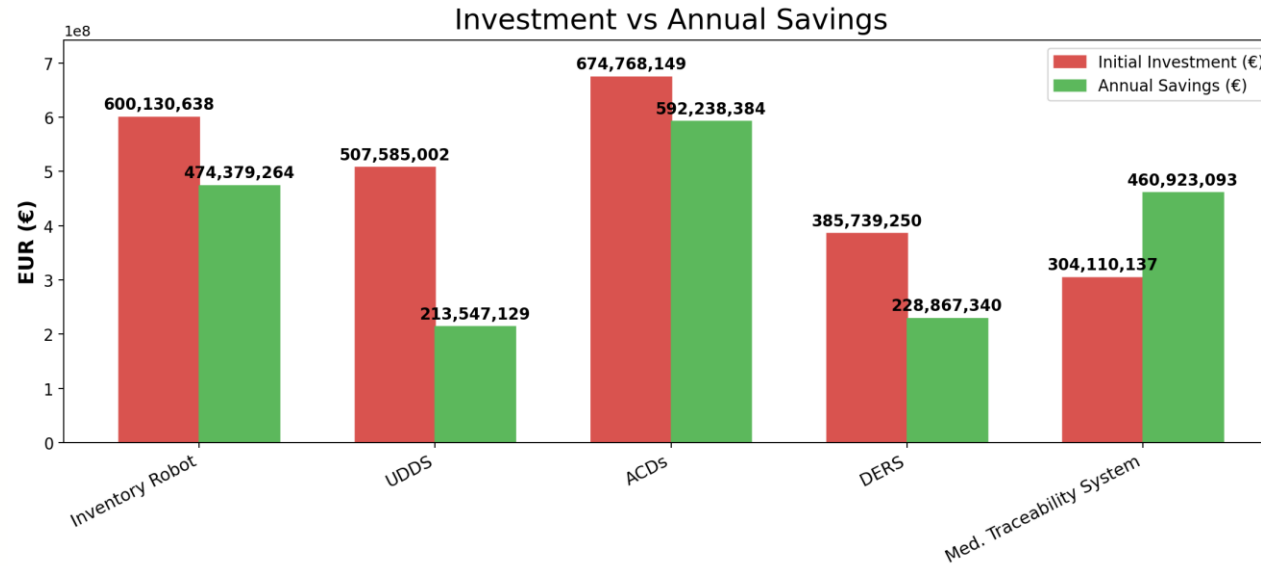


Methodology

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,

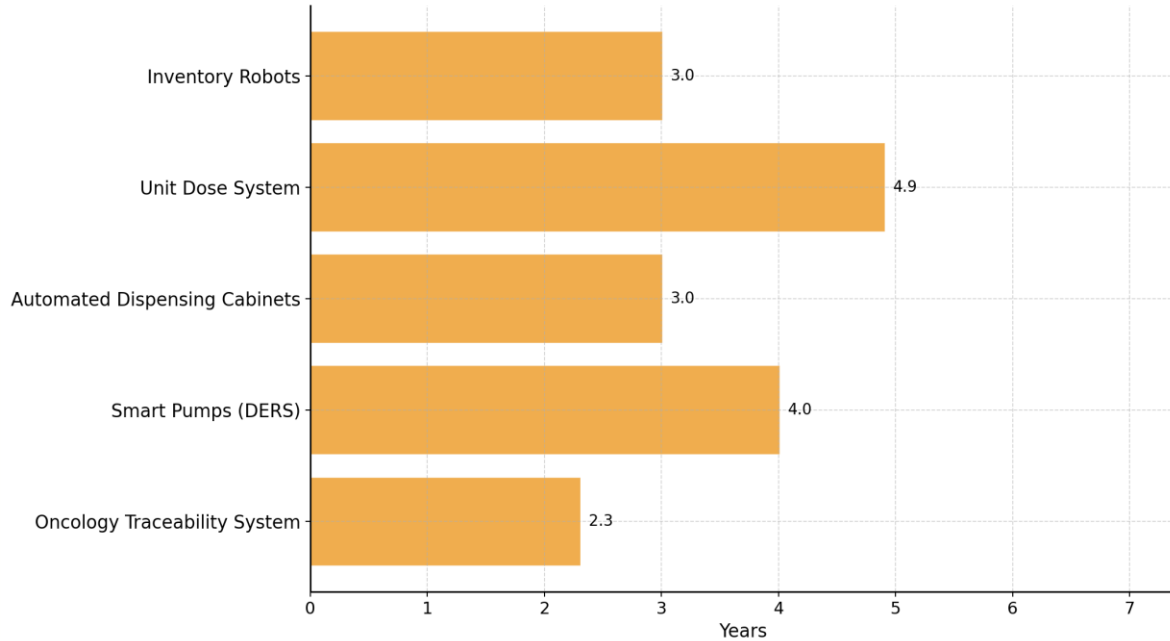
Technologies	Reduction of wasted medications	Stock reduction	Reduction of medication errors	Reduction of processing time
Inventory robots	–100% (Ahtiainen et al., 2020)	–26,4% (Giménez et al., 2019)	–16 % (Franklin et al., 2007)	–31,4% (technicians) (Ahtiainen et al., 2020)
Unit Dose System (UDDS)	–100 % (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

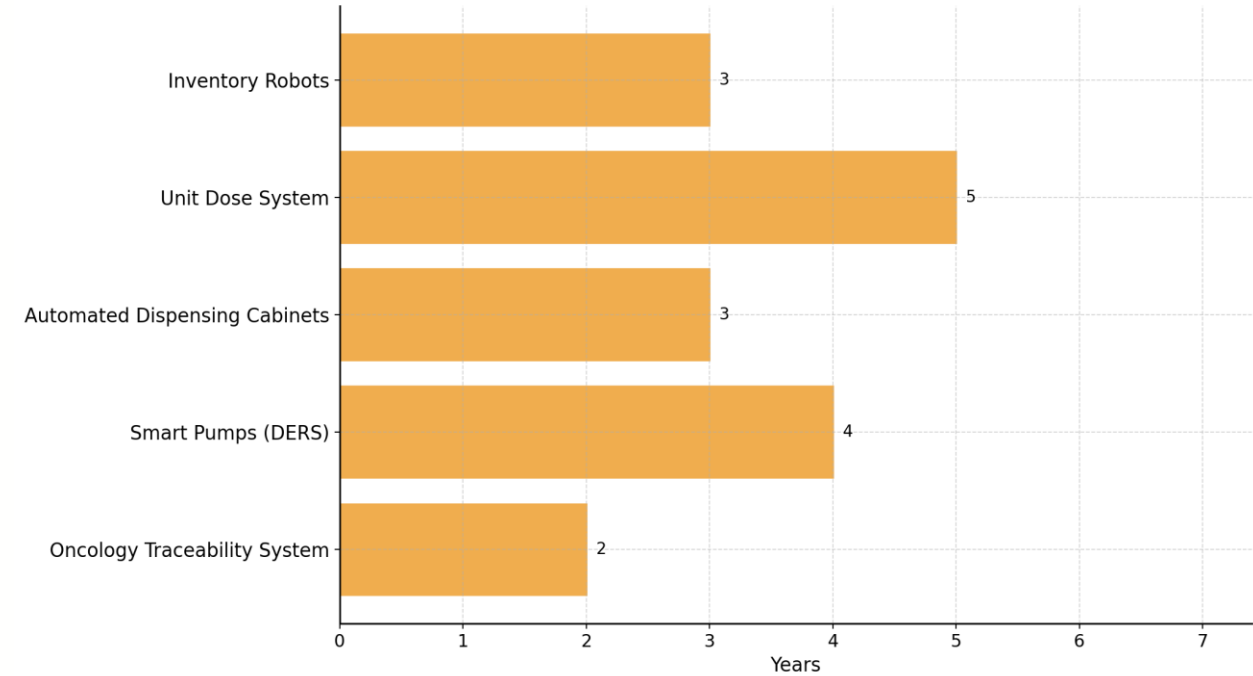


Payback Time – France & Belgium

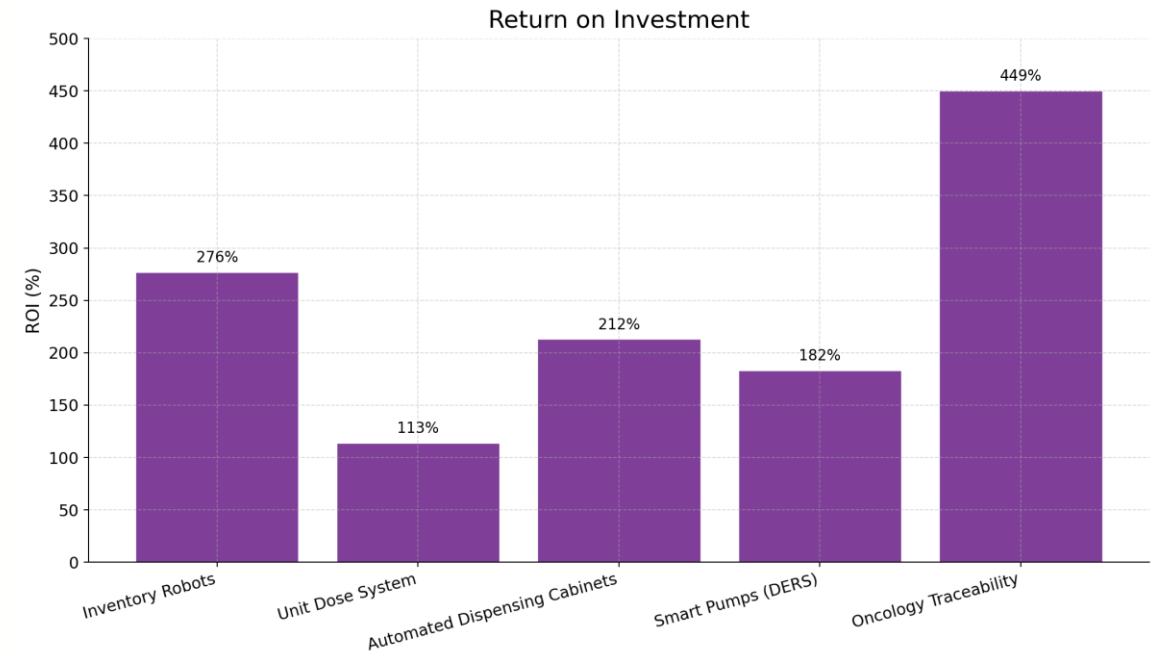
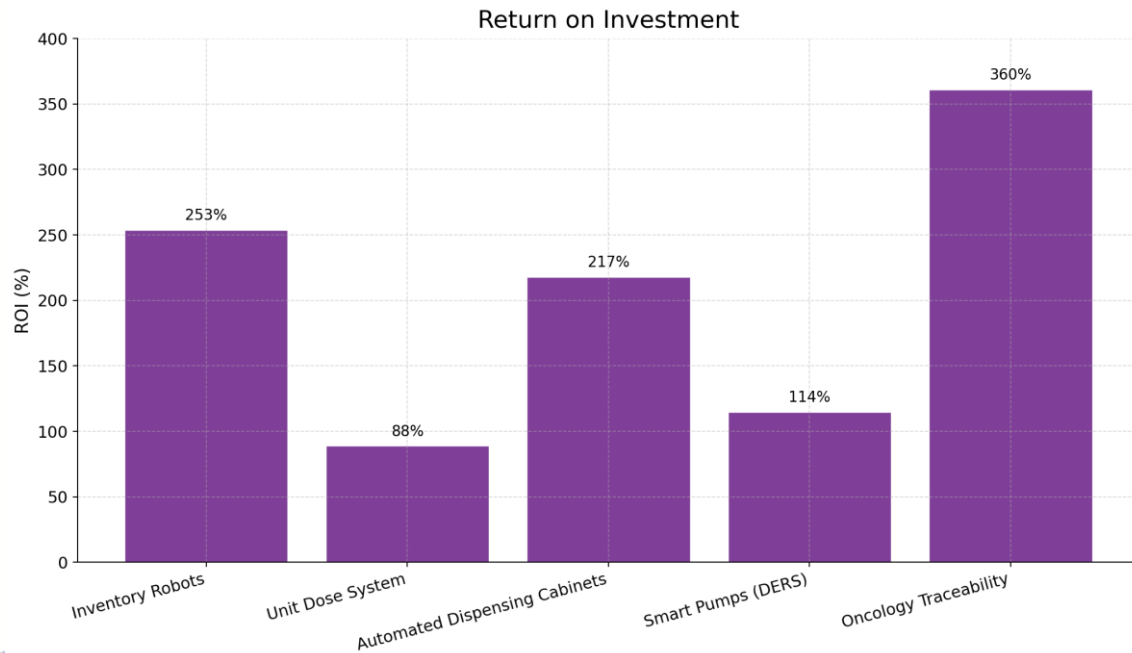
Payback Time



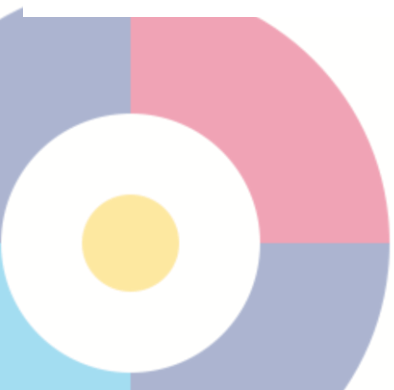
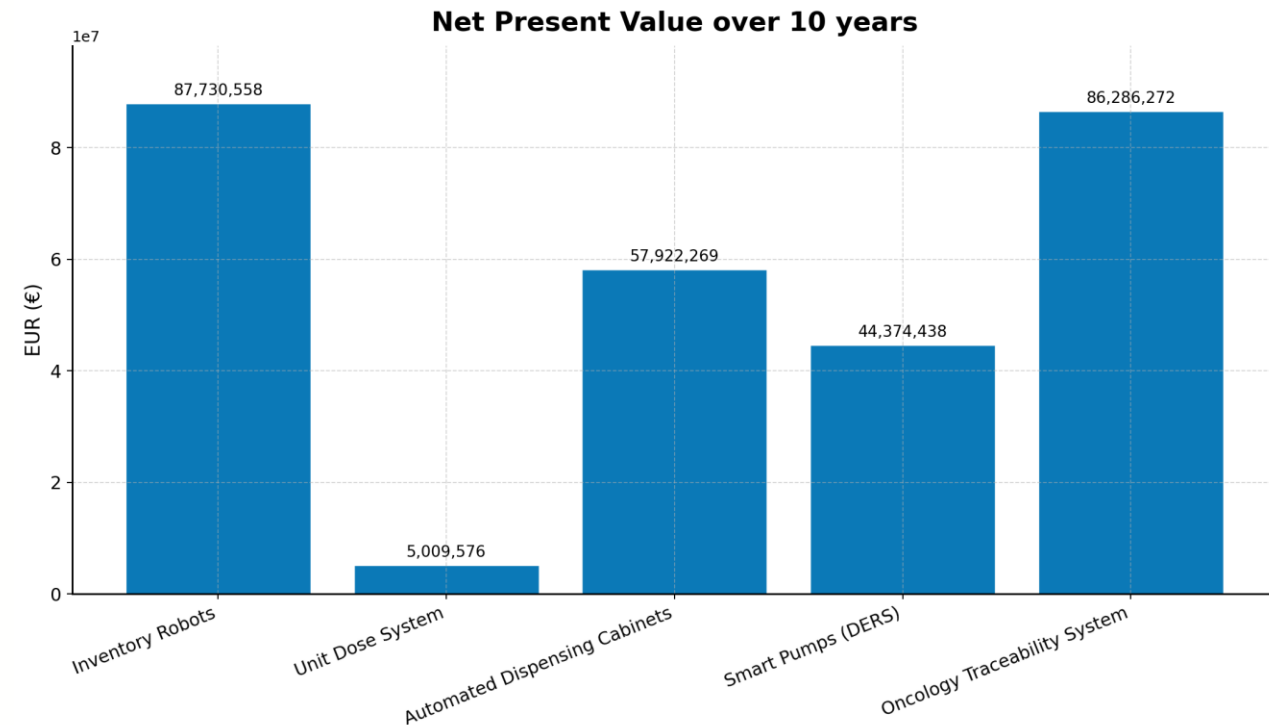
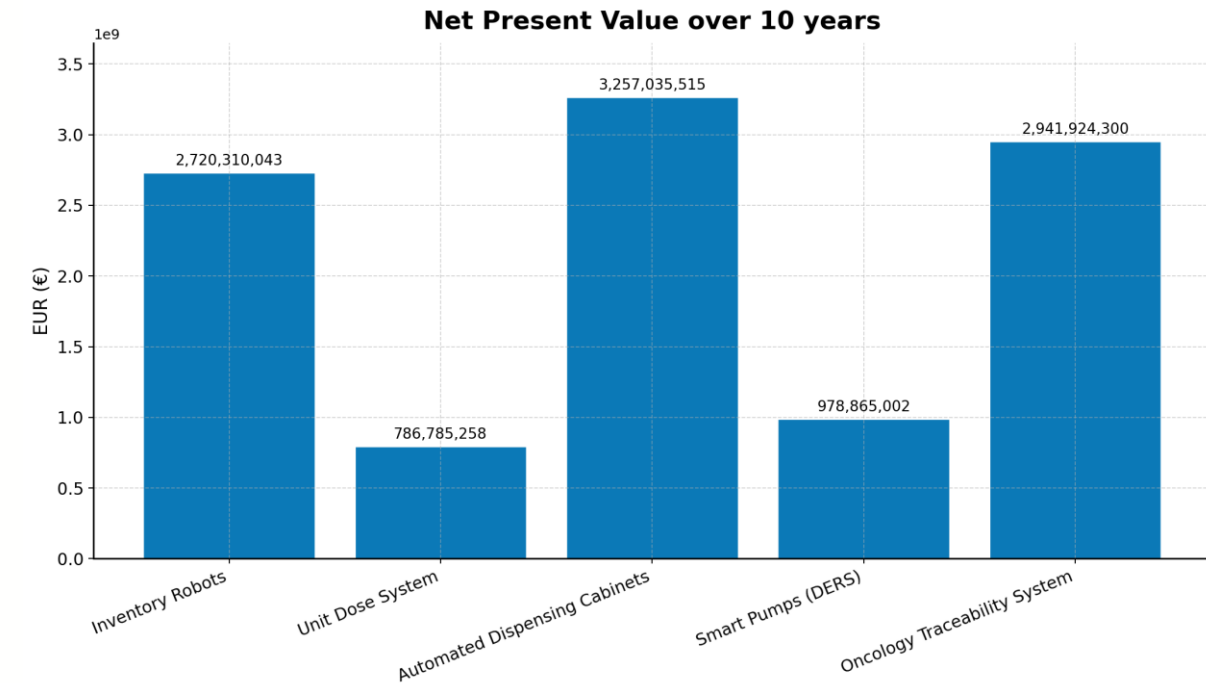
Payback Time



Return On Investment – 5 technologies



Net Present Value – France & Belgium

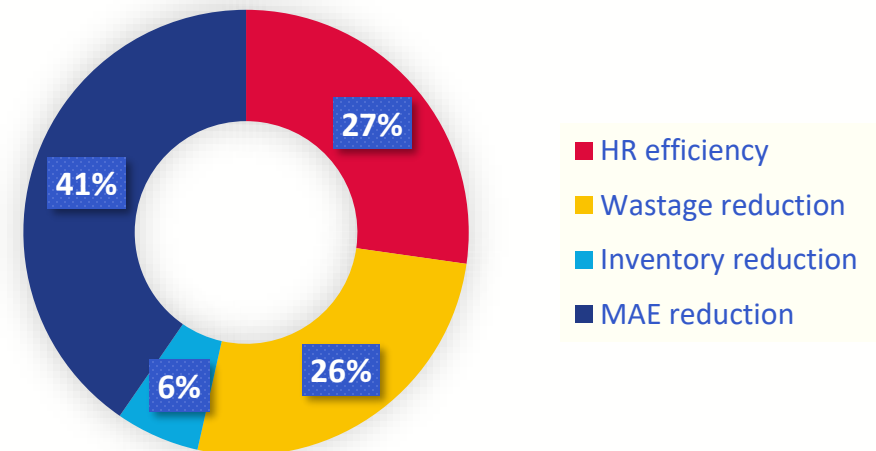


Savings Breakdown – Europe

Belgium (National)	HR efficiency savings	Wastage reduction savings	Inventory reduction savings	MAE reduction savings	Total Annual savings
Inventory Robots	4.763.417 €	8.788.508 €	1.813.639 €	259.263 €	15.624.827 €
Unit Dose System	711.227 €	456.403 €	0 €	64.749 €	1.232.380 €
ADCs	2.396.951 €	3.233.084 €	1.280.481 €	4.222.980 €	11.133.496 €
DERS	765.228 €	0 €	0 €	8.215.731 €	8.980.959 €
Traceability Onc.	5.195.135 €	847.750 €	0 €	7.743.082 €	13.785.966 €
Total	13.831.959 €	13.325.744 €	3.094.120 €	20.505.805 €	50.757.628 €



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.

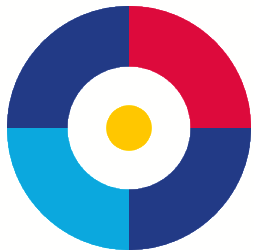


Thank you!

dbellavia@liuc.it



RESEARCH & APPLICATIONS
FOR BUSINESS





Sofie Peeters

Chief Hospital Pharmacist

AZ Turnhout

LEADERSHIP MASTERCLASS

Digital medication management in times of transformation

Sofie Peeters
Chief Hospital Pharmacist - AZ Turnhout

Experience from a hospital preparing for merger, regulatory change, digitalisation and future infrastructure.

AZ Turnhout

Merger context

New-build



Sofie Peeters

Chief Hospital Pharmacist AZ Turnhout

My work is primarily strategic and policy-oriented, with a focus on quality, governance and the future organisation of hospital pharmacy services.

I share this case from the perspective of AZ Turnhout, while working closely with colleagues from AZ Herentals and multidisciplinary partners across both hospitals.

The experiences presented today reflect teamwork and shared learning, not individual achievement.

Why this case study?

1

Digital medication management

Prescribing, clinical pharmacy, distribution and aseptic preparation

2

Transformation in a merger context

Different starting points and a phased path to operational integration

3

Practical lessons from pharmacy transformation

Maintaining safe and efficient daily medication management

Disclosure: I have no personal or commercial interests related to the technologies discussed in this presentation.

Why the pharmacy model needs to evolve

Legal merger

1 JANUARY 2027

- AZ Turnhout and AZ Herentals become AZ Kempen
- One legal organisation
- Pharmacy integration follows in phases

First pharmacy milestone

1 JANUARY 2028

- Centralisation of aseptic preparation
- Akwadraat supports both hospital sites
- Shared preparation workflows

New hospital in Turnhout

FUTURE SITE TURNHOUT

- New campus on the current Sint-Jozef site
- Pharmacy choices must remain fit for the future footprint
- Akwadraat remains external

One pharmacy transformation, designed for merger integration, aseptic centralisation and the future hospital footprint.

One legal merger, many pharmacy decisions

Formulary and medication logic

Align formularies, high-risk medication policies and prescribing logic.

Preparation protocols

Harmonise chemotherapy schemes, sterile preparation workflows and release logic.

Distribution model

Define central, decentral and hybrid flows before automating systems.

Clinical pharmacy

Align CMA rules, flowcharts, validation responsibilities and MFC governance.

Quality system

Use one shared approach for procedures, validation, training and documentation.

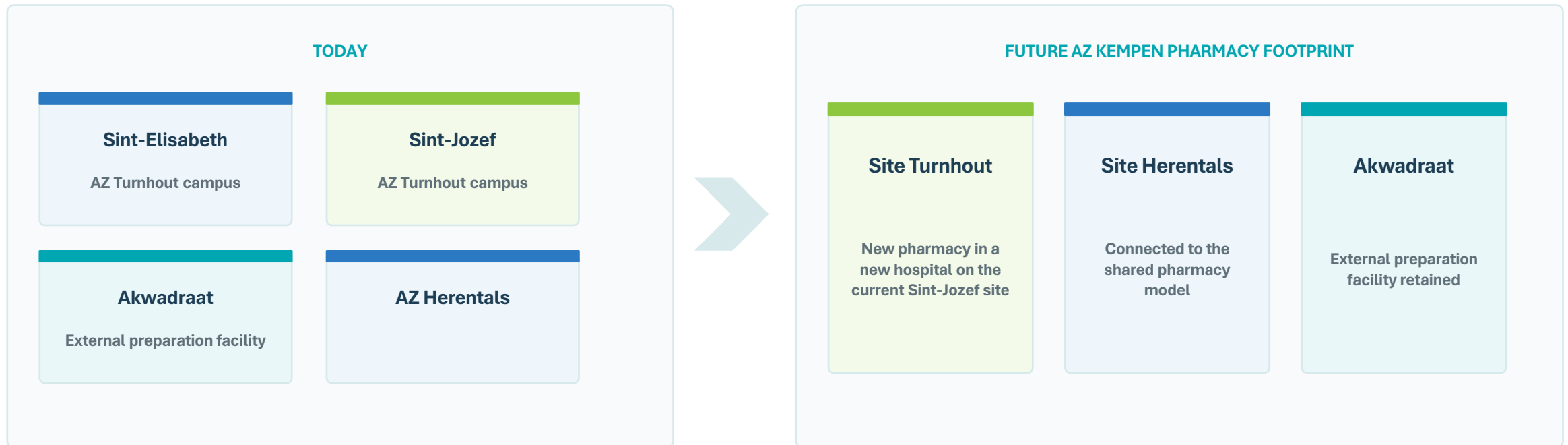
Digital systems

Connect EMV KWS, traceability and reporting to the future operating model.

The merger challenge is not choosing one tool. It is building one medication management model.

From four operational locations to three connected pharmacy locations

The footprint changes, but the focus remains one pharmacy model linking preparation, distribution and local access across the sites.



Different locations, connected through one future pharmacy model.

The people behind the transformation

The staffing figures refer specifically to the current AZ Turnhout pharmacy organisation.

18.5 FTE

Hospital pharmacists

29 FTE

Pharmacy staff

Multidisciplinary expertise

Clinical pharmacy • prescribing support • distribution
aseptic preparation • medical materials • quality
transformation projects

Technology enables transformation. People make it happen.

Medication management is becoming a strategic hospital priority

Digitalisation, automation and regulation are changing how hospitals organise safe medication care.

Safety expectations

Medication safety requires traceability, standardisation and reliable handovers.

Workforce pressure

Technology helps release scarce capacity for higher-value tasks.

Regulation

PIC/S, KB 1978 and KB 2020 increase quality and documentation requirements.

Cost and investment

Higher requirements often mean higher costs and infrastructure choices.

The question is no longer whether hospitals should digitalise medication management, but how.

Most people see medicines. Pharmacy manages the medication pathway.

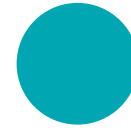
A hospital pharmacy supports care through multiple domains, from clinical decision support to logistics and preparation.



Clinical pharmacy



EMV and prescribing



Distribution



Production / preparation



**Medical materials,
implants & CSSD**



Network and projects

Pharmacy expertise helps clinicians focus on patients by taking ownership of medicines.

Clear language before talking about digitalisation

For non-pharmacy leaders, the distinction between distribution, production and clinical pharmacy must be explicit.

Distribution

How medicines move through the hospital: stock, unit dose, ward supply, bedside availability and traceability.

Production / preparation

How medicines are prepared: aseptic and non-sterile processes under quality requirements.

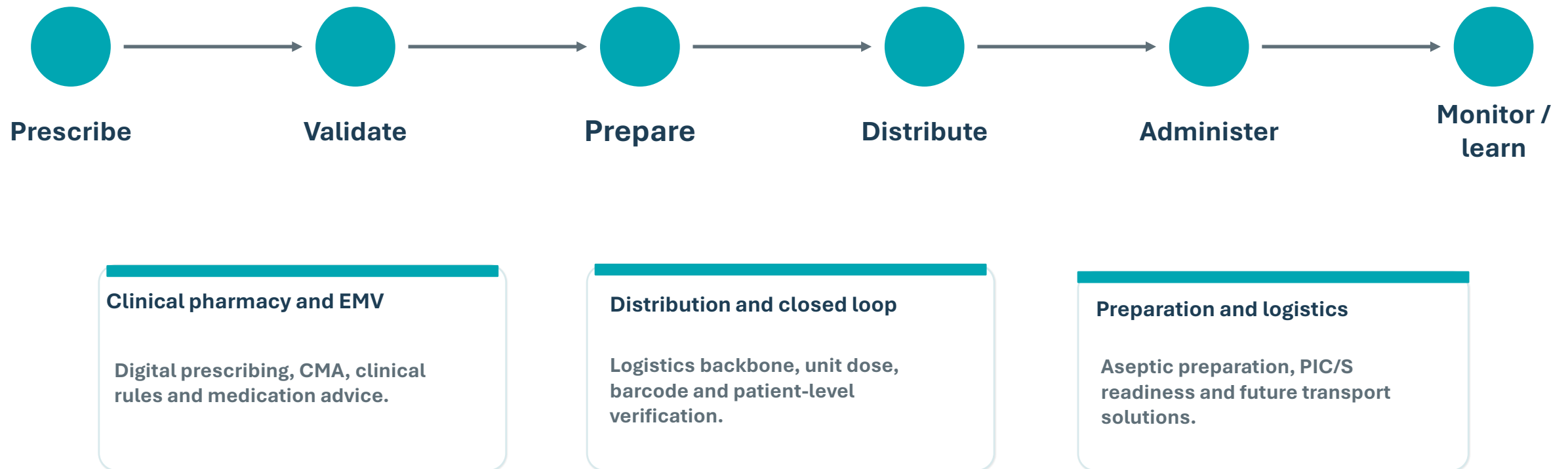
Clinical pharmacy

Safer and more appropriate medication therapy.

These domains are connected in one pathway, but they require different operating models.

A patient-centred way to understand digital medication management

Every step in the medication pathway can be made safer, more traceable and more efficient.



Four domains where digitalisation changes medication management

Clinical pharmacy & EMV

Digital prescribing and medication expertise close to the patient

Medication distribution

Hybrid distribution, logistics backbone and closed-loop safety

Aseptic preparation

PIC/S, investment logic and centralisation as pharmacy milestone

Smart logistics

Drones and network logistics as future support layer

Digitalisation is not an IT project. It is organisational redesign.

Medication safety starts before the prescription is sent

Electronic prescribing creates the basis for standardisation, clinical rules, templates and decision support.



Electronic prescribing

Shared digital prescribing basis.



Templates

Order sets for oncology, antibiotics and other structured pathways.



Clinical rules

Safety logic can be embedded before medication reaches the ward.



Helpdesk and training

Digital change needs support, not just software.

Standardised prescribing prevents avoidable variation later in the medication chain.

We focus on medicines so physicians can focus more on patients

Clinical pharmacy supports appropriate prescribing, detects interactions and translates medication risks into advice.



Medication appropriateness

Check whether medication is appropriate for the patient, diagnosis and clinical context.



Interactions and risks

Detect interactions, contraindications, dose issues and renal/hepatic considerations.



Advice to physicians

Provide actionable medication advice to strengthen patient safety.

Best practice principle

Move pharmacy expertise closer to the clinical decision.

Practical implication

This requires role design, prioritisation and collaboration with medical teams.

Digital enabler

EMV and clinical rules help scale clinical pharmacy expertise.

Similar decentralised models, with limited differences in pharmacy picking

Both hospitals currently rely on decentralised medication distribution with substantial ward stock. The main difference is a modestly higher level of pharmacy picking automation in AZ Turnhout.

Shared starting point

- Largely decentralised distribution
- Substantial ward stock
- Medication available close to care
- Similar underlying distribution philosophy

AZ Turnhout today

- Mainly decentralised model
- Pharmacy picking is slightly more automated
- Difference is limited, not fundamental

AZ Herentals today

- Mainly decentralised model
- More manual pharmacy picking
- Overall approach remains comparable

The opportunity is not to replace one model with another, but to harmonise and strengthen a shared future model.

Moving from decentralised supply towards stronger central coordination

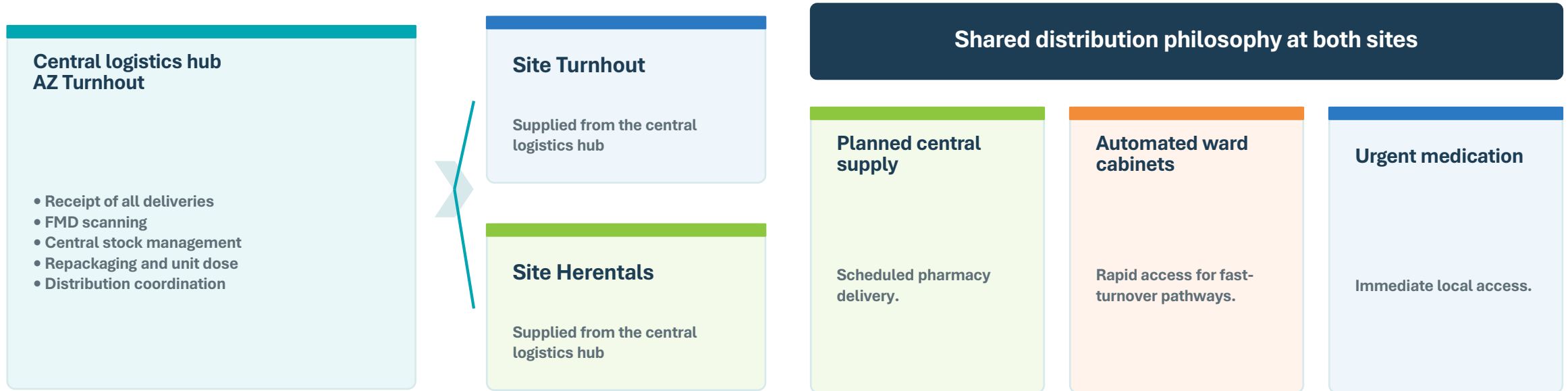
Both hospitals currently rely substantially on decentralised ward stock. The future model must improve consistency and traceability while moving as much supply as reasonably possible under central pharmacy control.



Centralise where feasible. Retain local availability where patient pathways require it.

One central logistics backbone, one shared distribution philosophy

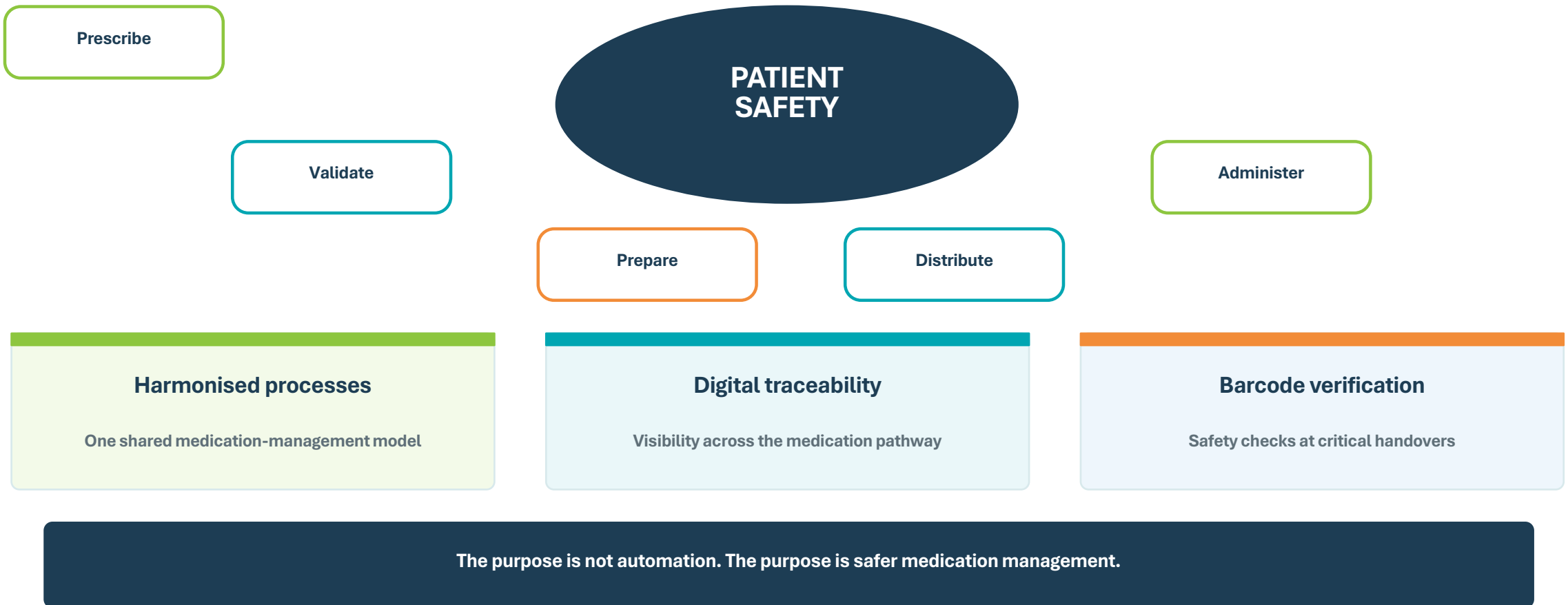
All medication flows originate from the logistics hub in Turnhout. At both hospital sites, the final supply model is determined by the patient pathway and required speed of access.



One central logistics backbone. One shared distribution philosophy. Different patient pathways.

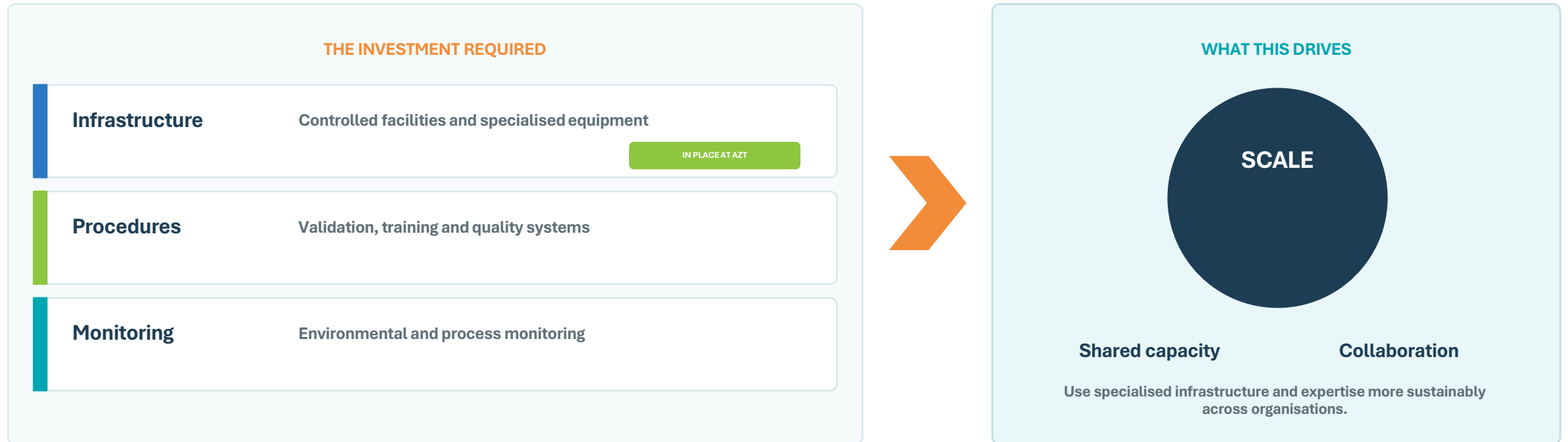
Why closed-loop medication management matters

The distribution model is an enabler. The objective is safer medication management across the entire pathway.



Why PIC/S is a game changer for aseptic preparation

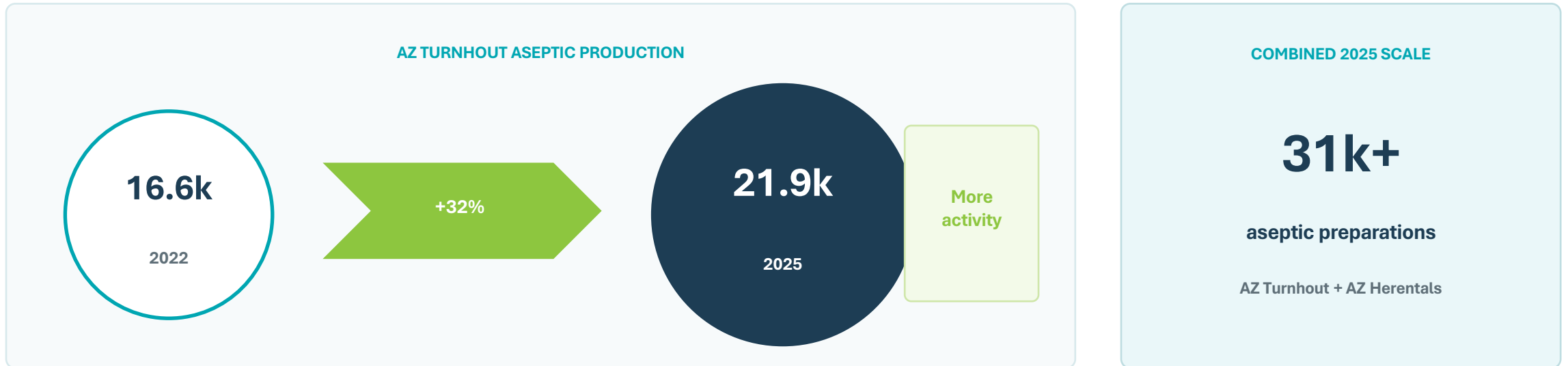
Higher quality expectations require major investment. Sustainable implementation increasingly depends on scale and collaboration.



PIC/S increasingly drives the need for investment, scale and collaboration.

Growing activity strengthens the case for scale

More preparations, under increasingly rigorous quality requirements, make effective use of specialised capacity essential.



Standardisation
one preparation logic



Digital control
traceability and validation



Shared capacity
use scale more effectively

Higher volumes and higher quality expectations make scale the logical choice.

Exploring drone transport with Skyports

The investment case is future logistics capacity, not only the replacement of road transport.



CT

Chemotherapy

Direct daytime flows from Akwadraat to Sint-Jozef and Sint-Elisabeth.

UD

Pharmacy unit dose

Potential frequent and predictable pharmacy flows between sites.

PS

Pathology samples

Repeatable flows with chain-of-custody and temperature requirements.

Why this matters

1

Support more frequent, predictable inter-site movements

2

Avoid unlimited growth in road capacity as services centralise

3

Create scalable capacity for future regional integration

4

Use drones only for selected, governed and suitable flows

The drone is not the strategy. It is one potential capacity layer in a future inter-site logistics network.

What our experience can offer other hospitals

The value of the pharmacy transformation lies in safety, standardisation, expertise and scalable logistics.



Start with patient safety

Do not start with technology. Start with the medication handover that needs control.



Standardise before automating

Standardise before automating.



Invest where scale matters

PIC/S and closed-loop requirements should support shared investment logic.



Protect clinical expertise

CMA, interaction screening and prescribing templates create safety before distribution.



Design for transition

Design for transition.

Digital transformation during a hospital merger

Practical lessons from leading organisational change while maintaining safe and efficient medication management.

What helps transformation succeed

- Start with process harmonisation
- Define the future operating model before selecting technology
- Invest in training and change management
- Communicate continuously
- Strong executive leadership support
- A committed pharmacy team with ownership and expertise

What remains challenging

- Different starting points
- Competing timelines
- Regulatory pressure
- Workforce and change fatigue
- Rising quality expectations vs. financial reality

Digital medication management is primarily an organisational transformation project.

Questions & discussion

Thank you

Sofie Peeters
Head of Pharmacy Services, AZ Turnhout

Quality

Safety

Future-ready

THANK YOU

WWW.EHMA.ORG 