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From Imhotep to Medicine Security Builders: Repositioning Pharmacy for Pharmaceutical Sovereignty and Health System Resilience in Africa

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Graphical Abstract: From Pharmacy Practice to Medicine Security Builders

Conceptual description for journal submission:

The graphical abstract illustrates the transformation of pharmacy from a **dispensing-centred profession** to a **systems-leadership profession** that supports pharmaceutical sovereignty.

Inputs

Education reform
Industrial partnerships
Regulatory strengthening
Digital pharmaceutical infrastructure

↓

Transformation Engine

Medicine Security Builders
Pharmacists are positioned as industrial scientists, regulatory strategists, digital health innovators and pharmaceutical entrepreneurs.

↓

System Outcomes

Medicine security
Resilient pharmaceutical supply chains
Local pharmaceutical manufacturing
Regional pharmaceutical trade under AfCFTA
Improved access to affordable medicines

↓

Long-Term Impact

Pharmaceutical sovereignty
Health system resilience
Economic development and industrialisation in Africa

The Medicine Security Builders framework illustrates the transformation of pharmacy education and practice into a strategic driver of pharmaceutical sovereignty, industrial development and medicine security across Africa.

ARTICLE INFO

Keywords:

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ABSTRACT

Background: Pharmacy is one of the oldest scientific professions, with its roots traced to ancient Egypt under the intellectual legacy of Imhotep. Over several millennia, the discipline evolved from herbal preparation and compounding to industrial pharmaceutical manufacturing, biotechnology innovation and digital health integration. Despite this long historical evolution, pharmacy practice across much of Africa remains disproportionately retail-oriented and highly dependent on imported medicines. This structural imbalance weakens medicine security and constrains pharmaceutical sovereignty.

Objective: This paper examines the historical evolution of pharmacy. It proposes a transformation framework that repositions the profession from producing résumé-oriented graduates to developing medicine security builders capable of strengthening pharmaceutical manufacturing, regulatory science, digital health integration and policy leadership.

Methods: A historical–analytical approach was used, drawing on literature from pharmaceutical history, health systems governance, regulatory science and pharmaceutical industrial policy.

Results: The analysis identifies key structural gaps in pharmaceutical education, regulatory capacity and industry integration. A conceptual model—the **Medicine Security Builders Framework**—is proposed to guide the transformation of pharmacy education and practice toward pharmaceutical sovereignty.

Conclusion: Repositioning pharmacy toward medicine security leadership will strengthen health security, improve pharmaceutical manufacturing capacity and enable Africa to build resilient pharmaceutical ecosystems.

1. Introduction

The intellectual origins of pharmacy can be traced to **Imhotep**, the renowned physician, architect and scholar of ancient Egypt during the 27th century BCE. Imhotep is widely regarded as the earliest recorded physician-pharmacist and symbolises the integration of scientific observation, medicinal formulation and health system leadership[1].

Ancient Egyptian medical texts such as the **Ebers Papyrus (c. 1550 BCE)** documented more than 800 medicinal formulations, demonstrating sophisticated pharmacological knowledge involving botanical, mineral and biological preparations[2,3].

As previously discussed in work examining the evolution of pharmacy across civilisations, the profession has consistently adapted to scientific, technological and societal transformations[4]. From herbal medicine traditions to synthetic chemistry and biotechnology, pharmacy has evolved as both a clinical and industrial discipline.

During the **Islamic Golden Age**, pharmacy emerged as a specialised profession with the establishment of early pharmacies in Baghdad and Persia. Scholars such as **Ibn Sina (Avicenna)** formalised pharmacopoeias and dosage forms, laying the foundations for pharmaceutical standardisation[5,6].

The industrial revolutions of the nineteenth and twentieth centuries further transformed pharmacy through advances in **synthetic chemistry, microbiology and industrial pharmaceutical manufacturing**[7,8].

In the twenty-first century, pharmaceutical systems are increasingly shaped by **artificial intelligence, telepharmacy, blockchain-enabled traceability and digital pharmacovigilance**[9].

Despite these advances globally, the pharmaceutical landscape across much of Africa remains characterised by **high dependence on imported medicines**, limited manufacturing capacity and fragmented pharmaceutical supply chains.

Addressing these structural challenges requires repositioning the pharmacy profession toward **medicine security leadership and pharmaceutical sovereignty**.

2. Medicine Security as a Strategic Imperative

Medicine security refers to the sustained capacity of healthcare systems to ensure reliable access to safe, effective, quality-assured and affordable medicines.

The COVID-19 pandemic exposed the fragility of global pharmaceutical supply chains and highlighted the risks faced by regions heavily dependent on imported medicines.

Africa imports a significant proportion of finished pharmaceutical products and active pharmaceutical

ingredients (APIs), leaving healthcare systems vulnerable to geopolitical disruptions, logistical bottlenecks and currency fluctuations[10].

In previous work on **Africa's path to pharmaceutical sovereignty**, it was argued that medicine security should be viewed as both a public health and economic development priority[4].

Strengthening medicine security requires capabilities in:

- pharmaceutical manufacturing
- API synthesis
- regulatory science
- health technology assessment
- digital pharmaceutical supply chains
- industrial pharmaceutical financing

These capabilities demand a pharmacy workforce trained beyond traditional dispensing roles.

3. From Résumé Builders to Medicine Security Builders

Pharmacy education in many African universities continues to focus primarily on preparing graduates for employment within **community and hospital pharmacy practice**.

While these roles remain vital, they are insufficient to support pharmaceutical industrialisation and medicine security.

A new orientation is therefore required. Pharmacy graduates must evolve from **résumé builders** seeking employment to **medicine security builders** capable of strengthening national pharmaceutical ecosystems.

This expanded professional identity requires competencies in:

- pharmaceutical formulation science
- API synthesis and industrial chemistry
- regulatory science and dossier development
- pharmacoeconomics and health technology assessment
- digital health systems
- pharmaceutical entrepreneurship

Pharmacy education must therefore align more directly with the strategic goal of **pharmaceutical sovereignty**.

4. The Medicine Security Framework

Medicine security can be conceptualised as a systems architecture consisting of interconnected components that collectively ensure reliable access to medicines.

Figure 1. Medicine Security Framework

Five interdependent pillars supporting resilient pharmaceutical systems

Figure 1. Medicine Security Framework

The Medicine Security Framework illustrates five interdependent pillars required for resilient pharmaceutical systems: pharmaceutical manufacturing capacity, regulatory system maturity, pharmaceutical workforce competence, digital pharmaceutical infrastructure, and regional market integration. Together, these pillars enable reliable access to safe, effective, quality-assured and affordable medicines while supporting pharmaceutical sovereignty and health system resilience.

5. Pharmacy Workforce Transformation Model

Transforming pharmacy education requires a shift from traditional practice roles toward a diversified pharmaceutical workforce capable of supporting industrial development.

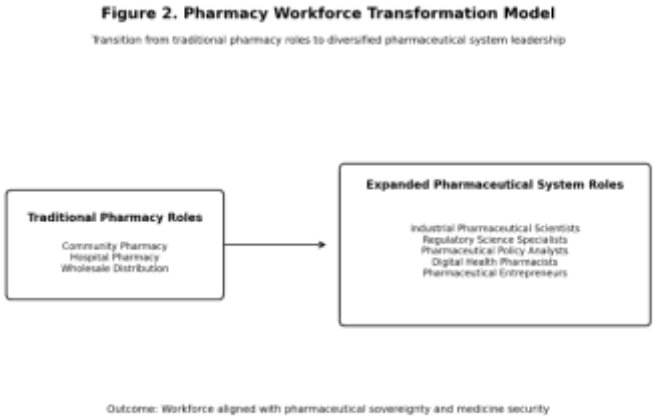

Figure 2. Pharmacy Workforce Transformation Model

The model illustrates the transition of pharmacy practice from traditional roles centred on community and hospital pharmacy toward diversified professional roles within pharmaceutical manufacturing, regulatory science, policy leadership, digital health systems and pharmaceutical entrepreneurship. This transformation aligns the pharmacy workforce with the broader objective of strengthening medicine security and pharmaceutical sovereignty.

This transformation aligns pharmacy education with broader national development priorities.

6. The Medicine Security Builders Framework

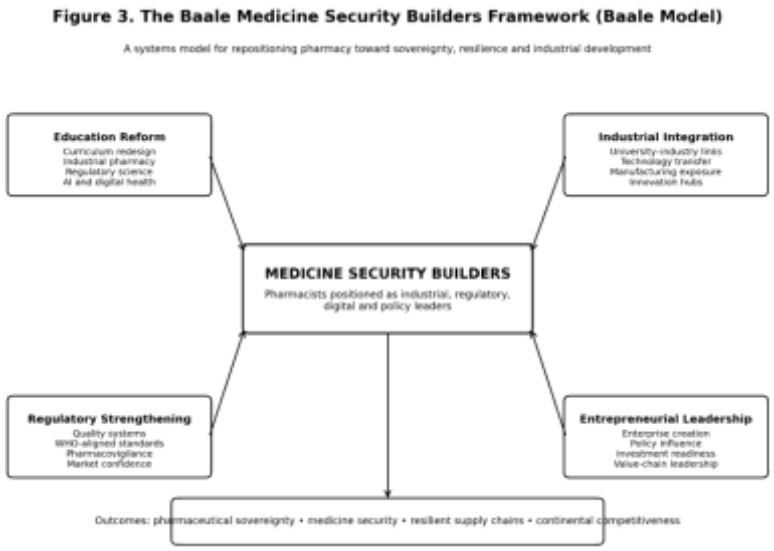

Figure 3. The Baale Medicine Security Builders Framework (Baale Model)[11,12].

The Baale Model conceptualises pharmacy transformation through four mutually reinforcing pillars—education reform, industrial integration, regulatory strengthening and entrepreneurial leadership. These pillars reposition pharmacists as medicine security builders capable of strengthening pharmaceutical manufacturing capacity, regulatory credibility, innovation ecosystems and resilient medicine supply chains.

Problem

Many African countries remain highly dependent on imported medicines and active pharmaceutical ingredients. This dependence exposes healthcare systems to supply disruptions, currency shocks and geopolitical risks, undermining medicine security and weakening pharmaceutical sovereignty.

Despite decades of discussion on pharmaceutical industrialisation in Africa, the role of **pharmacy education and the pharmaceutical workforce** in enabling pharmaceutical sovereignty has received limited conceptual attention.

Core Concept

This paper introduces the **Medicine Security Builders Framework (Baale Model)**, which proposes transforming pharmacy education and professional practice from a **dispensing-centred model** to a **systems leadership model** that supports pharmaceutical sovereignty.

Under this framework, pharmacists are repositioned as **medicine security builders**—professionals capable of strengthening pharmaceutical manufacturing, regulatory science, digital health systems and pharmaceutical policy.

Four Strategic Pillars

The framework identifies four mutually reinforcing pillars required to transform the pharmacy profession.

Education Reform

Pharmacy curricula must expand beyond dispensing to include industrial pharmacy, regulatory science, pharmacoeconomics, pharmaceutical policy, artificial intelligence and digital health systems.

Industrial Integration

Universities must strengthen partnerships with pharmaceutical manufacturers, biotechnology firms and innovation hubs to support research translation, technology transfer and workforce development.

Regulatory Strengthening

Strong regulatory systems aligned with global standards are essential for ensuring the quality of medicines, attracting investment, and building confidence in locally manufactured medicines.

Entrepreneurial Leadership

Pharmacists should be encouraged to become pharmaceutical entrepreneurs, innovators and policy leaders capable of driving value creation across pharmaceutical supply chains.

Expected System Outcomes

Implementation of the Medicine Security Builders Framework contributes to:

- Strengthened pharmaceutical manufacturing capacity
- Reduced medicine import dependency
- Improved medicine affordability and access
- Resilient pharmaceutical supply chains
- Enhanced regional pharmaceutical integration through AfCFTA

Strategic Significance

The framework connects **pharmacy workforce transformation with pharmaceutical industrial policy**, positioning the profession as a key driver of health security and economic development in Africa.

By linking education reform, industrial development and regulatory strengthening, the Baale Model provides a conceptual roadmap for transforming pharmacy into a **strategic pillar of medicine security and pharmaceutical sovereignty**.

7. Comparative Models of Pharmacy Practice

Table 1. Current Pharmacy Model vs Medicine Security Builder Model

Dimension	Current Pharmacy Model	Medicine Security Builder Model
Primary orientation	Dispensing and retail supply	Systems leadership for medicine security
Workforce identity	Job-seeking, résumé-oriented graduates	Nation-building, industry-shaping professionals
Core practice setting	Community and hospital pharmacy	Manufacturing, regulation, research, digital health, policy and entrepreneurship
Dominant competence base	Product knowledge, dispensing, routine patient counselling	Formulation science, API strategy, regulatory science, pharmacoeconomics, supply chain intelligence and policy leadership
Educational emphasis	Licensure preparation and clinical dispensing	Industrial competence, innovation, translational science and leadership for sovereignty
Exposure during training	Hospitals, community pharmacies, wholesalers	Manufacturing plants, regulatory agencies, research hubs, innovation ecosystems and industrial clusters
Regulatory outlook	Compliance as obligation	Regulation as market-enabling infrastructure and confidence builder
Digital orientation	Basic ICT support	AI-enabled pharmacy, digital pharmacovigilance, traceability and data-driven decision-making
Research focus	Academic output with limited commercial translation	Innovation, patents, technology transfer and scalable product development
Industry linkage	Weak or episodic	Structured university–industry–government collaboration
Economic contribution	Medicine distribution and service delivery	Local value creation, industrial expansion, export readiness and resilience
Strategic metric of success	Employment rates, licensure pass rates, dispensing volume	Reduced import dependency, stronger local manufacturing, improved affordability and better health outcomes
Continental role	Nationally fragmented practice	Regional integration through AfCFTA-aligned pharmaceutical ecosystems
Long-term contribution	Professional service continuity	Pharmaceutical sovereignty, medicine security and national resilience

8. Discussion

The analysis highlights a structural paradox within the African pharmaceutical landscape. While demand for medicines continues to grow due to population expansion and epidemiological transitions, domestic pharmaceutical production capacity remains limited.

This imbalance reinforces reliance on imported medicines and undermines medicine security.

The transformation of pharmacy education, therefore, represents a strategic intervention capable of addressing this structural challenge.

Historically, the development of the pharmaceutical industry in Europe and North America was accompanied by the expansion of pharmaceutical sciences education and industrial pharmacy training.Africa must pursue a similar trajectory. However, strengthening pharmaceutical education alone is insufficient. Sustainable pharmaceutical development requires alignment among **education, industry and government institutions**, consistent with the **Triple Helix model of innovation**[13].

Regulatory institutions also play a central enabling role. Strong regulatory systems increase confidence in locally manufactured medicines and encourage pharmaceutical investment.

As previously emphasised in work on pharmaceutical sovereignty[4], the future of Africa's pharmaceutical sector depends on building integrated pharmaceutical ecosystems **that combine scientific capability, industrial production, and regulatory credibility**.

The proposed **Medicine Security Builders Framework** provides a conceptual roadmap for achieving this transformation.

9. Policy Recommendations for Governments and Universities

For Governments

Governments should elevate medicine security to a national development priority and align health, industry, education and trade policies around pharmaceutical sovereignty.

Public procurement policies should encourage quality-assured local manufacturing, while regulatory systems must be strengthened to meet the WHO maturity standards.

Financial incentives, innovation funds and pharmaceutical industrial parks should be developed to support domestic pharmaceutical production.

Regional cooperation through **AfCFTA** should be leveraged to harmonise regulatory standards and strengthen regional pharmaceutical markets.

For Universities

Universities should redesign pharmacy curricula to incorporate industrial pharmacy, regulatory science, pharmaceutical economics and digital health.

Training should include placements in manufacturing plants, regulatory agencies and pharmaceutical innovation hubs.

Universities should also establish stronger partnerships with pharmaceutical companies to facilitate research commercialisation and technology transfer.

Entrepreneurship training should encourage pharmacists to create enterprises across the pharmaceutical value chain.

10. Implications for Africa's Pharmaceutical Industrialisation

Repositioning pharmacy toward the Medicine Security Builder Model has profound implications for Africa's pharmaceutical industrialisation.

First, it expands the talent pipeline required to support pharmaceutical manufacturing, regulatory science and supply chain management.

Second, it strengthens the innovation ecosystem by linking pharmaceutical education more directly to product development and technology transfer.

Third, it enhances confidence in locally manufactured medicines by strengthening regulatory and professional competencies.

Finally, it supports regional competitiveness by producing professionals capable of operating within an integrated continental pharmaceutical market under AfCFTA.

The future of Africa's pharmaceutical sector will therefore depend not only on factories and financing but also on the **type of professionals the continent trains**.

11. Discussion

Recent global health events have renewed attention on the strategic importance of **local pharmaceutical manufacturing in Africa**.

The COVID-19 pandemic and subsequent outbreaks such as mpox highlighted the vulnerability of import-dependent regions in accessing essential medicines and vaccines[14]. Strengthening local pharmaceutical production has therefore emerged as a key pillar of health security across the continent.

Recent policy reports emphasise that Africa must invest significantly in domestic pharmaceutical production to reduce reliance on imports and build resilient health systems. More than **70 % of medicines consumed in Africa are currently imported**, while pharmaceutical production capacity remains concentrated in a small

number of countries[15].

Similarly, continental policy initiatives, such as the Pharmaceutical Manufacturing Plan for Africa (PMPA), aim to develop a competitive, sustainable pharmaceutical manufacturing industry capable of improving access to essential medicines while generating economic benefits[16,17]

Recent global health analyses also highlight that weak pharmaceutical manufacturing capacity contributes directly to inequitable access to medicines across Sub-Saharan Africa. Structural barriers, such as limited technology transfer, restrictive intellectual property frameworks, and underinvestment in pharmaceutical infrastructure, continue to limit local production.

These developments reinforce the central argument of this paper: **pharmaceutical sovereignty requires not only industrial infrastructure but also a workforce capable of sustaining pharmaceutical ecosystems**.

The transformation of pharmacy education, therefore, represents a strategic intervention within broader pharmaceutical industrial policy.

12. Conceptual Contribution

This paper contributes to the emerging discourse on pharmaceutical sovereignty by proposing a **new professional transformation framework for pharmacy education and practice in Africa**.

The existing literature on pharmaceutical development in Africa has largely focused on industrial policy, regulatory strengthening, and supply chain reforms[15,18]. While these factors remain critical, relatively little attention has been given to the **human capital architecture required to sustain pharmaceutical sovereignty**.

The principal conceptual contribution of this study is therefore the introduction of the **Medicine Security Builders Framework (Baale Model)**[11,12].

The model advances three important theoretical propositions.

First, pharmaceutical sovereignty is not solely a function of manufacturing infrastructure or regulatory policy. It also depends on the **professional orientation and competencies of the pharmaceutical workforce**.

Second, pharmacy education must evolve from a **distribution-centred professional paradigm** to a **systems leadership paradigm** that integrates manufacturing science, regulatory strategy, digital health and industrial policy.

Third, pharmacists can function as **strategic actors within national pharmaceutical ecosystems**, contributing not only to clinical care but also to pharmaceutical innovation, industrialisation and policy development.

By linking **workforce transformation to pharmaceutical industrial policy**, the Baale Model provides a conceptual bridge between pharmacy education, health system resilience and economic development.

This contribution complements broader continental initiatives such as the **Pharmaceutical Manufacturing Plan for Africa (PMPA)** and the **Africa CDC initiatives on local health product manufacturing**, which aim to strengthen regional pharmaceutical production ecosystems[17].

13. Conclusion

The four-million-year evolution of pharmacy demonstrates a profession characterised by continuous reinvention.

In the African context, the next stage of this evolution must focus on **medicine security and pharmaceutical sovereignty**.

Repositioning pharmacists as **medicine security builders** will strengthen pharmaceutical manufacturing, regulatory systems, digital health integration and policy leadership.

Through this transformation, pharmacy can reclaim its historic mission—not only dispensing medicines but also **building resilient pharmaceutical systems that protect health and support economic development across Africa**.

References

1. Blomstedt, P. (2014). Imhotep and the discovery of cerebrospinal fluid. *Acta Neurochirurgica Supplement*. doi: 10.1155/2014/256105.
2. Metwaly AM, Ghoneim MM, Eissa IH, Elsehemy IA, Mostafa AE, Hegazy MM, Afifi WM, Dou D. (2021) Traditional ancient Egyptian medicine: A review. *Saudi Journal of Biological Sciences*, 10):5823-5832. doi: 10.1016/j.sjbs.2021.06.044.
3. Baldrick, T. (2022). The surprisingly advanced medicine of ancient Egypt. The Collector.
4. Baale L. (2025). The Evolution of Pharmacy: From Imhotep to the Modern Era. *Archives of Biotechnology and Pharmaceutical Research*,

2025;1(1):19-21.
5. Toklu, H.Z. (2013). The changing face of pharmacy practice—Journal of Pharmacy and Pharmaceutical Sciences.
6. Toklu HZ, Hussain A. (2013) The changing face of pharmacy practice and the need for a new model of pharmacy education. *Journal of Young Pharmacists*, 5(2):38-40. doi: 10.1016/j.jyp.2012.09.001.
7. Urick, B.Y. (2019). Evolution of pharmacy practice and education. Research in Social and Administrative Pharmacy.
8. Urick BY, Meggs EV. (2019). Towards a Greater Professional Standing: Evolution of Pharmacy Practice and Education, 1920-2020. Pharmacy (Basel), 7(3):98. doi: 10.3390/pharmacy7030098
9. Hippensteele, A. (2024). AI in pharmacy: Transforming medication management. Pharmacy Times.
10. WHO (2023). Global Benchmarking Tool for Evaluation of National Regulatory Systems. Geneva: World Health Organisation.
11. Baale L. (2026). From Imhotep to Medicine Security Builders: Repositioning Pharmacy for Pharmaceutical Sovereignty and Health System Resilience in Africa. *Archives of Biotechnology and Pharmaceutical Research*, 2(1):59-64.
12. BaaleL.J(2026). "Africa's Path to Pharmaceutical Sovereignty and Renaissance: Building Champions at Home". *Acta Scientific Pharmaceutical Sciences* 10.3: 01-04.
13. Etzkowitz, H. and Leydesdorff, L. (2000). The dynamics of innovation: From national systems to Triple Helix. *Research Policy*, 29 (2):109-123
14. Ndembi, N. et al. (2024). 'Local pharmaceutical manufacturing and health security in Africa'. *Global Health Policy Review*.
15. UNCTAD (2025). *Building the Case for Investment in Local Pharmaceutical Production in Africa*. Geneva: United Nations Conference on Trade and Development.
16. African Union (2022). African Continental Free Trade Area: Operational Framework and Pharmaceutical Opportunities. Addis Ababa: African Union Commission
17. Africa CDC (2025). *Africa's Progress Towards Sustainable Local Manufacturing of Health Products*. Addis Ababa: Africa Centres for Disease Control and Prevention.
18. WHO (2024). *Framework for Strengthening Local Production of Medicines, Vaccines and Health Technologies in the African Region 2025–2035*. Geneva: World Health Organisation.