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ТРАНСГРАНИЧНАЯ СТАНДАРТИЗАЦИЯ: СКРЫТЫЕ ИЗДЕРЖКИ ФРАГМЕНТАЦИИ ИНЖЕНЕРНЫХ НОРМ И СТАНДАРТОВ В СТРАНАХ ЭКОВАС

Аннотация: Африканская континентальная зона свободной торговли (АфЗСТ) предусматривает рост трансграничных инфраструктурных и промышленных проектов, что усилило потребность в нормативно-технической гармонизации в Экономическом сообществе западноафриканских государств (ЭКОВАС). Однако существуют значительные различия в инженерных нормах, стандартах обеспечения качества и безопасности между государствами-членами, которые остаются препятствиями для реализации проектов. В данной статье рассматриваются причины фрагментации инженерных стандартов, произошедшей в ЭКОВАС, и последствия такой фрагментации, а также анализируется ее влияние на затраты, сроки и управление рисками проектов. В ней используются элементы институциональной теории, экономики транзакционных издержек и отдельные тематические исследования из регионов, чтобы показать, как расходящиеся стандарты могут приводить к неэффективности закупок, переработке проектов и дорогостоящему соблюдению требований. Предлагается поэтапный подход к гармонизации посредством соглашений о взаимном признании, разработки регионального приложения ЭКОВАС к международным стандартам и инвестиций в совместную инфраструктуру обеспечения качества. Результаты исследования подчеркивают, что стандартизация является стратегическим фактором, способствующим региональной интеграции и эффективному управлению инженерными проектами в Западной Африке.

Ключевые слова: Управление инженерными проектами, ЭКОВАС, Стандартизация, Африканская континентальная зона свободной торговли (AfCFTA), Проектные риски, Обеспечение качества, Трансграничная инфраструктура.

Standardization Across Borders: The Hidden Cost of Fragmented Engineering Codes in ECOWAS

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Abstract: African Continental Free Trade Area (AfCFTA) envisages the growth of Cross-Border Infrastructure and Industrial Projects that have intensified the demand for regulatory and technical harmonization in the Economic Community of the West African States (ECOWAS). But there are important variations in engineering codes, quality assurance and safety standards across the Member States that remain obstacles to project implementation. This article addresses the reasons for the engineering standard fragmentation that has occurred in ECOWAS and the implications of such fragmentation, followed by an analysis of its impact on the cost, schedule and risk management for projects. It uses elements of institutional theory, transaction cost economics and selected case studies from regions to show the ways in which divergent standards can lead to inefficiencies in procurement, rework of designs, and costly compliance. It suggests a gradual harmonization approach through agreements of mutual recognition, the development of an ECOWAS regional annex for international standards and investment in joint quality infrastructure. The findings highlight standardization as a strategic enabler of regional integration and effective engineering project management in West Africa.

Keywords: Engineering Management, ECOWAS, Standardization, AfCFTA, Project Risk, Quality Assurance, Cross-Border Infrastructure.

1. Introduction: The Invisible Barrier to Regional Integration

Assume that one of the engineering and construction companies of Ghana has been given a competitive bid to build a modern, climate-controlled logistics center in neighboring Benin, where the climate is very different. The structural design is optimized for cost-efficiency and made from high tensile steel (e.g., S355 grade) which is ideally suited to all Ghana Standards Authority (GSA) and British Standard (BS) specifications. The project is on track, and a regional supply chain is mapped.

However, when the structural steel arrives at the border it gets stuck for 6 weeks. The local regulatory body in Benin refuses to accept the material certification because it does not have documentation corresponding to French Norms (NF/AFNOR) and specific regional safety protocols which were not considered in the original design. This leads to serious schedule delays, rising demurrage charges, unhappy client and a costly redesign to procure locally approved substitutes and or re-test with an independent, third party.

This is not a theoretical scenario – it is a real, on-going challenge for engineering managers, project directors, and leaders in the supply chain in the Economic Community of West African States (ECOWAS) [1]. However, there is a major hurdle to the infrastructure growth in West Africa that lies

beneath the surface: the deep lack of standardization and consolidation of engineering codes, quality assurance (QA), and safety standards.

In the engineering management field, this is not simply a practical headache, it's a serious strategic threat. It is an invisible NTB that raises project costs, disrupts schedules and hinders, rather than facilitates, regional integration as envisioned in macroeconomic programs such as AfCFTA [2]. This article delves into the theoretical and practical origins of the gap, estimates its cost on project management metrics, and offers an actionable and strategic plan for engineering leaders and region-level institutions to help move projects toward harmonization.

2. Theoretical Framework and Literature Review

The fragmentation of engineering standards in ECOWAS cannot be explained solely within a technical perspective, as it is a complex socio-technical phenomenon, which arises from institutional path dependency. The continued presence of different British, French and Portuguese standards in West Africa symbolizes the persistence of "coercive isomorphism" described in Institutional Theory by DiMaggio & Powell, in which the post-colonial regulatory bodies inherited and perpetuated the normative frameworks of the former metropoles [4].

This separation can be best understood from an Engineering Management point of view in the context of Transaction Cost Economics (TCE). The costs of bounded rationality and opportunism are high for cross-border projects when there is information asymmetry, according to TCE [5]. The absence of harmonized standards in the ECOWAS context is a huge information asymmetry. Engineering managers have to deal with ex-ante transaction costs such as time spent on regulatory mapping and design reviews and ex-post transaction costs such as delays at borders, contractual issues around material equivalency, and rework.

The United Nations Economic Commission for Africa (UNECA) has recently conducted research and found that divergent technical standards and conformity assessment procedures are important factors that hinder integration of value-chains and efficient delivery of cross-border infrastructure projects in West Africa [6]. The Strategy for the Harmonization of Standards in Africa (SHSA) has been promoted by the African Regional Organization for Standardization (ARSO), but there is weak implementation, with national capacities varying, and protectionist tendencies appearing as quality control [3, 7].

Table 1

Comparative Overview of Engineering Standards in Selected ECOWAS Member States

Country	Primary Standards Body	Dominant Design Codes (Civil/Structural)	Electrical / Grid Codes	Key Cross-Border Challenges
Ghana	Ghana Standards Authority (GSA)	British Standards (BS) / Eurocodes	Ghana Grid Code (IEC based)	Divergence from Francophone material certifications; redundant testing.
Nigeria	Standards Organization of Nigeria (SON)	British Standards (BS) / Local SON Codes	Nigerian Grid Code	Complex local content laws overlapping with foreign standard requirements.
Senegal	Association Sénégalaise de Normalisation (ASN)	French Norms (NF) / Eurocodes	UMOA Regional Grid Standards	Strict adherence to AFNOR; limited mutual recognition with Anglophone bodies.
Côte d'Ivoire	Bureau de Normalisation de Côte d'Ivoire (BNCI)	French Norms (NF)	UMOA Regional Grid Standards	Bureaucratic delays in approving non-Francophone engineering designs.

Source: Compiled from ARSO harmonization reports, national standards body publications and regional infrastructure audits [3, 7].

3. The Business Case: Impact on the Project Management "Iron Triangle"

The iron triangle of project management, Cost, Time, Scope/Quality [9] is directly applicable in Engineering Management for each of these technical variables. If all three don't have harmonized standards, the risks become quite volatile, and project threatening.

3.1. Supply Chain Bottlenecks and Procurement Inefficiency

Engineering is based on optimized and just in time supply chains. A lack of standards causes procurement managers not to be able to benefit from regional economies of scale. World Bank analyses of African trade logistics indicate that conformity assessment procedures, including testing,

inspection, and certification requirements, remain significant contributors to trade frictions and administrative costs within regional markets [8]. These additional compliance requirements can increase procurement complexity, extend lead times, and reduce opportunities for cost optimization in engineering projects.

3.2. Design Rework and Scope Creep

Engineering companies tend to engineer to their home-country specifications with the intention of reusing software libraries from their home country. If the host country's standards are applied during the project, then a chain reaction of revisions results. Seismic coefficient is different for different buildings; wind load calculations are different; and the pavement design methodology is different (e.g., AASHTO vs. French LCPC methods) - all of which require engineers to recalculate loads from scratch. This rework costs hundreds of hours of unplanned engineering work and contributes to major scope creep and project handover delays.

3.3. Elevated Risk and Liability in QA/QC

Ambiguous liability structures arise where the standards are fragmented and hence the liability structure is unclear, especially when a project is subject to an international contract form such as FIDIC, which may conflict with local statutory requirements. When there is misalignment, contractual conflicts occur, leading to contractual disputes under Clause 1.4 (Law and Language) and Clause 8.4 (Extension of Time) [10]. This means that technical QA/QC problems become long-term lawsuits and increases the cost of professional indemnity policies.

Table 2

Estimated Impact of Standard Fragmentation on Cross-Border Project Metrics

Project Phase	Typical Impact of Fragmentation	Estimated Cost/Schedule Variance	Recommended Mitigation Strategy
Feasibility & Design	Redundant design reviews; conflicting load/material codes; delayed permitting.	Increased engineering effort and potential schedule delays.	Conduct early "Regulatory Mapping"; engage host-country authorities pre-design.

Procurement	Rejection of certified materials at borders; forced re-sourcing; demurrage.	Increased procurement costs and potential delivery delays.	Prioritize suppliers with dual-certification (e.g., BS/ISO and AFNOR).
Construction & QA/QC	Redundant inspections; conflicting safety protocol enforcement; dispute resolution.	Increased administrative burden and elevated legal or contractual risk.	Advocate for Mutual Recognition Agreements (MRAs) for QA auditors and labs.

Source: Author's synthesis based on project management principles outlined by PMI and contractual risk considerations identified in FIDIC frameworks [9, 10].

4. Empirical Case Studies: The Cost of Fragmentation in Practice

To quantify the theoretical impacts of standard fragmentation, this section examines two documented cross-border infrastructure initiatives within ECOWAS.

Case Study A: The West African Power Pool (WAPP) Interconnections

The purpose of WAPP is to develop a single regional electricity market. Interconnection projects (such as Ghana-Burkina Faso and Nigeria-Benin transmission lines) have, however, had a long history of challenging commissioning delays. One of the main technical challenges has been the difference in grid codes and equipment specifications. For example, protection relay settings and transformer testing procedures defined under the Ghana Grid Code (mostly IEC/BS based) have often been re-validated by Francophone counterparties, based on UMOA/AFNOR settings and procedures [11]. This lack of mutual recognition can result in longer 'testing and commissioning' periods, thereby increasing project overheads and the delay to the benefits of regional energy trading.

Case Study B: The Abidjan-Lagos Corridor Highway Project

This 1000+ km long transnational highway is one of the AfCFTA enablers. But there are now some discrepancies in the pavement design, and material specification, which have become major risks. Design methodologies associated with British Standards or AASHTO are used in Anglophone sections (Ghana, Nigeria) while the Francophone sections (Côte d'Ivoire, Benin, Togo) use the methods of the French Laboratoire Central des Ponts et Chaussées (LCPC) [12]. When contractors cross borders, the bitumen grade, the testing of the aggregates and compaction requirements all change suddenly. Such differences in the implementation of regional road projects can result in

rework at border crossings where materials accepted in one jurisdiction require additional approval, testing or documentation in another, creating schedule delays and additional compliance costs [2, 12].

5. The Catalyst for Change: AfCFTA and Regional Megaprojects

What is the need for harmonization at this time? The answer is in the macroeconomic movement towards regional integration, which is being led by the implementation of the African Continental Free Trade Area (AfCFTA) [1].

The AfCFTA seeks to create a single continental market for goods and services and to promote economic integration and a higher level of cross border trade in Africa [1]. One of the principle aspects of this arrangement is the free movement of goods and services. If the engineering standards that regulate these goods are still divided, though, free trade is theoretical. If each and every border crossing needs a new and redundant engineering certification, you will not have frictionless trade in construction materials.

This need is enhanced by the magnitude and complexity of the current ECOWAS mega projects which require absolute technical interoperability. To realize the benefits of these transformative projects, harmonization is not a function of the conference room, it is a business, operational and safety need for ECOWAS.

6. A Strategic Roadmap for Harmonization

This problem can only be addressed in a strategic, step-by-step manner. A multi-layered roadmap is to be developed between engineering managers, industry associations and regional policy makers.

Phase 1: Short-Term – Leverage Mutual Recognition Agreements (MRAs)

The industry can't afford to wait for a combination of perfect, unified codes. The first and most immediate answer is the expansion of the aggressive program of Mutual Recognition Agreements (MRAs). The testing and certification of high-volume engineering materials should be automatically recognized by national standards bodies in partner countries through MRAs that agree to this approach in accordance with the International Laboratory Accreditation Cooperation (ILAC) MRA framework. Likewise, there is a need to promote mutual recognition of professional engineering licenses among regional engineering institutions.

Phase 2: Medium-Term – Develop the "ECOWAS Annex" to Global Standards

It is difficult and costly to create new codes that are stand-alone for West Africa. The "Regional Annex" model is a more pragmatic one. ECOWAS, in collaboration with ARSO, should use

internationally accepted standards (ISO or Eurocodes) as a minimum requirement and modify it using an "ECOWAS Annex". This annex would also cover local realities (e.g., local climatic conditions, seismic activity profiles), and would accept locally manufactured alternative materials as a substitute for the global standard if they were sustainable and met the performance criteria of the global standard, giving the impression of a paradigm shift from prescriptive engineering to performance-based engineering.

Phase 3: Long-Term – Invest in Shared QA/QC Infrastructure

A good standard is as good as its monitoring system. ECOWAS should invest in regional accredited testing laboratories that are well distributed across the region to be world class. In addition, it would be possible to develop a uniform training and certification scheme for QA/QC auditors, thus allowing one certified auditor to perform inspections and sign off on compliance in any member state, instead of multiple inspections being carried out at a local level.

7. The Role of the Engineering Manager: Actionable Takeaways

Regional bodies or organizations are working at the macro level of the roadmap, but engineering managers can't wait. In today's environment, being reactive to solve a problem is no longer sufficient; it demands an approach to cross-border project leadership that is proactive and strategic – and one that involves managing risk. It is imperative for the engineering leaders of today's ECOWAS to take three immediate steps to make their project management frameworks more relevant:

1. **Conduct Early "Regulatory Mapping":** Use conceptual design phase to reference all differences between home country and host country standards. Include any possible redesign/redundant testing costs and timelines in the base project schedule and Risk Register.
2. **Engage Stakeholders Proactively:** Start engaging with the host country's standards authority prior to finalization of design or procurement orders. Apply for provisional approvals or "equivalency rulings" at an early stage in the process.
3. **Advocate for Dual-Certification in Procurement:** Focus during the tendering of contract documents on manufacturers who offer dual certification of the product (e.g., materials with both BS/ISO and AFNOR accreditation). This gives much flexibility in the supply chain, and greatly de-risks the project life cycle.

8. Conclusion

The vision of a single, economically dynamic West Africa is now attainable. But it's the professionals who make it happen - the designers, builders and managers of these projects. Standardization across borders is not about wiping out national identity or reducing safety

requirements, it's about improving the engineering standard, creating trust between nations and removing artificial obstacles that hinder the region.

Today's engineering manager must understand the complexities of cross-border standards, and it's not a unique ability but a key skill. In order to make use of the benefits of harmonization, MRAs, project planning with regulatory intelligence and performance-built design, engineering leaders can turn a historical barrier into a sustainable competitive advantage.

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