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REVIEWER'S REPORT

Manuscript No.: IJAR-59116

Title: Multi-Cloud Database Architecture for Saudi Enterprises: Improving Scalability, Data 1 **Sovereignty and Digital Resilience under Vision 2030**

Recommendation:

Accept as it is .....

Accept after minor revision.....

Accept after major revision .....yes.....

Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality			Y	
Techn. Quality			Y	
Clarity			Y	
Significance			y	

Reviewer's ID: JPR-Dr.Shaweta sachdeva

Detailed Reviewer's Report

1. The manuscript is primarily conceptual and narrative in nature. The authors should provide a clearer and more systematic explanation of the methodology used for literature selection, including search databases, keywords, inclusion/exclusion criteria, publication period, and the number of studies initially identified and finally included.
2. The proposed six-domain framework is interesting, but its novelty should be articulated more explicitly. The authors should clearly distinguish their framework from existing multi-cloud database, sovereignty, and resilience frameworks.
3. The placement-score equation presented in the methodology is conceptual, and the manuscript appropriately states that the weights are not universal constants. However, an illustrative example or hypothetical workload-based calculation would help demonstrate how the proposed decision model can be applied in practice.
4. The manuscript discusses scalability extensively, but there is no quantitative evaluation of scalability, latency, replication overhead, recovery time, or cost. Since these are central aspects of the proposed architecture, the authors should either provide experimental validation or strengthen the discussion explaining how these parameters could be empirically evaluated.
5. The four architectural patterns—active-active, active-passive, segmented multi-cloud, and portable recovery—are clearly described. However, the criteria for selecting one pattern over another could be made more measurable by defining specific decision parameters such as RTO, RPO, transaction volume, latency tolerance, data sensitivity, and cost thresholds.
6. The manuscript introduces a "hybrid sovereign core" pattern in Table 1, while the earlier six-domain framework emphasizes four major multi-cloud patterns. The authors should clarify whether the hybrid sovereign core is an additional architectural pattern or a variation/composition of the proposed patterns.
7. The Saudi regulatory discussion is an important contribution, but the manuscript should provide more precise mapping between individual regulatory requirements and the proposed technical controls. A detailed requirement-to-control mapping would improve the practical value of the framework.

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8. Regulatory requirements can evolve over time. Since the framework relies significantly on Saudi policies and regulations, the authors should clearly identify the versions and effective dates of the regulations considered and discuss how regulatory changes would be incorporated into the proposed governance model.
9. The distinction between data residency and operational sovereignty is valuable, but the manuscript could strengthen this section by providing a concrete enterprise scenario illustrating how data may remain physically within Saudi Arabia while administrative or operational dependencies remain external.
10. The resilience model would benefit from quantitative target examples. Although the authors correctly state that RTO/RPO should be organization-specific, illustrative ranges for different workload tiers would make the proposed model easier to operationalize.
11. The manuscript emphasizes cyber-recovery, but the proposed architecture could provide greater detail on ransomware scenarios, compromised credentials, backup integrity verification, immutable storage, and recovery from malicious database modifications.
12. The security section should discuss identity federation and cross-cloud identity management in greater technical depth, particularly because fragmented identity and shared control-plane dependencies are identified as important risks.
13. The manuscript mentions unified observability, but it would be useful to specify which metrics should be monitored across clouds. For example, replication lag, transaction conflicts, RTO/RPO compliance, backup success, configuration drift, security events, network latency, and cost could be incorporated into a common monitoring model.
14. The proposed architecture would benefit from a more detailed technical architecture diagram showing databases, application layers, identity services, key management, replication/change-data-capture mechanisms, monitoring, backup repositories, and cross-cloud communication paths. The current figures are described as conceptualizations, so greater technical detail would improve reproducibility.
15. The manuscript should provide at least one or two representative Saudi enterprise use cases—for example, banking, healthcare, government services, telecommunications, or e-commerce—to demonstrate how data classification and regulatory constraints influence architecture selection.
16. The discussion of cost and FinOps is relatively brief compared with scalability, sovereignty, and resilience. Since multi-cloud can introduce significant duplication, data-transfer, licensing, monitoring, and operational costs, a more detailed cost model or cost-related decision framework is recommended.
17. Some claims regarding the Saudi regulatory environment should be carefully cross-checked against the latest official versions of the relevant regulations and controls. The authors should ensure that terminology, scope, applicability, and data-transfer requirements are represented precisely.
18. The literature review could be strengthened by including more recent empirical studies and practical implementations of multi-cloud database architectures, particularly studies published in 2025–2026.
19. The manuscript would benefit from a dedicated comparison with existing frameworks/models in the literature, showing dimensions such as portability, sovereignty, resilience, security, scalability, governance, and empirical validation. This would make the research gap and contribution more evident.
20. The limitations section appropriately acknowledges the absence of empirical benchmarking. However, the authors should more explicitly discuss limitations associated with generalizing the proposed framework across different Saudi sectors because regulatory obligations, workload characteristics, and data classifications may differ considerably.

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21. The conclusion largely reiterates the framework and its principles. It could be made more effective by explicitly summarizing the key research contribution, practical contribution, and the specific validation that remains necessary.
22. The references should be carefully checked for consistency in author names, publication details, DOI formatting, institutional names, document versions, and access dates. In particular, references to Saudi governmental documents should use the exact official titles and current versions.
23. The manuscript should undergo a thorough language and formatting review. There are instances of awkward line breaks, hyphenation artifacts, and formatting inconsistencies that appear to have resulted from document conversion.
24. The authors should ensure that every major claim derived from regulatory documents or prior research is supported by an appropriate citation and that all cited references appear consistently in the reference list.
25. Overall, the manuscript has a relevant topic and presents a potentially useful conceptual framework, but additional methodological transparency, stronger evidence of novelty, clearer technical implementation details, and empirical or case-based validation would substantially improve its academic contribution and practical applicability.