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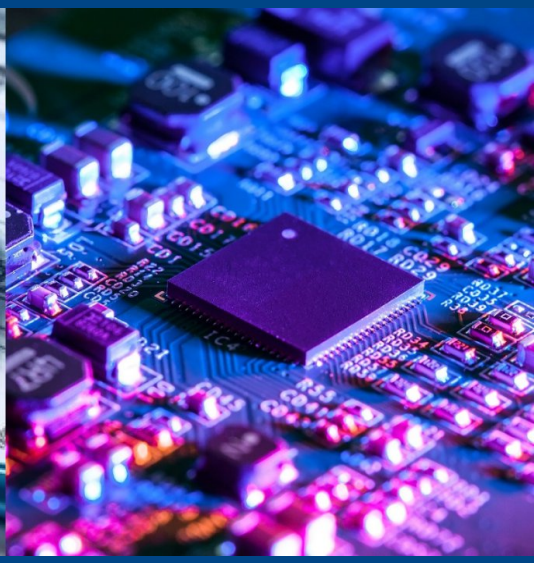

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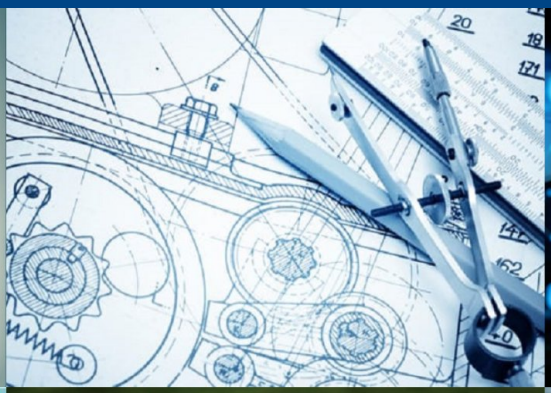

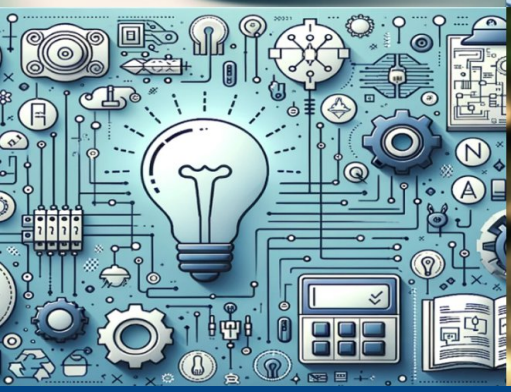

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NEOM SKY Stadium

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ABSTRACT: The NEOM Sky Stadium is a futuristic sports venue planned within NEOM, integrated into the vertical city of The Line. Positioned high above ground, it redefines traditional stadium design by combining advanced engineering, sustainability, and urban integration. Designed for major events like the FIFA World Cup 2034, it represents innovation in architecture, though it remains a supported structure rather than a floating one.

I. INTRODUCTION

The view of stadiums and sport parks has historically signified being a place for celebrating sports and hosting large events. However, the evolution of architectural, urban, and social practices calls for reimagining stadiums and sport parks to be integrated as part of their surrounding communities and the wider city. This study explores the best practices to integrate stadiums and sport parks into their surrounding urban tissue, with more focus on the cultural and regional practices that would ensure comprehensive integration of the promising stadiums being developed the context of Saudi Arabia taking into consideration the upcoming hosting of major international sporting and non-sporting events.

Figure 1: Current Cloud Scenario

II. LITERATURE REVIEW

Literature on the NEOM Sky Stadium, part of NEOM and The Line, highlights its role in advancing vertical urban design and sustainable architecture. Studies emphasize integration within a smart city, efficient land use, and renewable energy systems. Research linked to the FIFA World Cup 2034 discusses its multi-purpose and long-term use. However, some literature questions its feasibility, cost, and the practicality of its futuristic design.

Giffinger et al. 2007

This study aims to promote sustainable urban development by adopting the smart city approach by identifying the concept of smart cities in the reality of the cities of Gaza Strip, considering Khan Younis city as a case study. It also focuses on formulating a future vision using geographic information systems (GIS) and building information modeling (BIM) using current city data and plans. For this purpose, a checklist is designed to investigate the current reality of

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Khan Younis towards the concept of smart cities. It consists of two parts. The first one includes the demographic data while the second part involves nine axes; the availability of institutional infrastructure, availability of physical infrastructure, availability of social infrastructure, availability of economic infrastructure, availability of smart management components, use of smart city tools, achievement of the city's 3D goals, evaluation the level of use of GIS/BIM in decision supporting, as well as assessing the degree of challenges prevent transforming towards the smart city approach.

Hollands 2008

Starting from the definition of smart cities, characterized by flexible information processes, innovation facilitation mechanisms, smart and sustainable solutions and platforms, the new urban scenario highlights the creation of value as the core purpose and the central process of exchange between actors. According to this consideration, the present work aims at re-reading smart cities in the light of value co-creation practices, trying to capture the factors that local administrators can leverage to pursue a more acute development of local communities. The work follows an exploratory approach by using, in particular, the single case model (holistic), with the purpose to analyse the value co-creation practices (Frow et al., 2014) in the context of smart city. Specifically, the city of Turin has been chosen, focusing on the initiative promoted along with the Torino smart city Foundation. Eight value co-creation practices are identified, in order to determine the set of attributes leading to the transformation process in smart cities. In addition, for each type of practice specific measures are identified.

Caragliu et al. 2011

The paper proposes the re-conceptualization of the smart city as a service system, in line with the recent service theories, such as Service-Dominant logic and Service Science, Management, Engineering, and Design. Starting from a short literature review about service system and smart city, a model characterized by a reticular configuration is proposed. The framework identifies the most adequate organizational layout to foster resources exchange, value co-creation and enhance co-learning among multiple actors. The goal is to highlight that the development of collaborative logics, resulting in continuous processes of cooperation between public and private decision-makers and citizens, allows multiplying moments of value creation as a result of synergistic interactions.

Batty et al. 2012

In order to explore the research hotspots and development trends of digital grassroots governance abroad, this study focuses on 227 documents related to "Digital Grassroots Governance" within the Scopus database, covering a span of nearly 20 years (2005-2023). We utilized CiteSpace software to perform a visual analysis of these documents. Subsequently, we constructed keyword co-occurrence networks and cluster maps to better comprehend the landscape of "digital grassroots governance". The study reveals that foreign research on Digital Grassroots Governance primarily revolves around three core areas: public participatory governance, regional research on digital grassroots governance, and aspects related to smart city technology and services. Based on these key thematic areas, we can summarize three major research directions in foreign digital grassroots governance.

Cohen 2013

This study addresses teacher supervision in a context of linguistic diversity using data from the OECD's Teachingand Learning International Survey (TALIS, 2013) in which school leaders (N = 7438) from 36 OCDE-member countries participated. Factor analyses on the principals' supervision practices enabled us to identify three forms of supervision: administrative, pedagogical, and professional (career development). Kendall tau-b correlations revealed that the principals' administrative and career development supervision correlated with the linguistic diversity of the students. Also discussed is the impact of this linguistic diversity on the administrative supervision provided and the teacher professional development.

Relevance to current Research

The NEOM Sky Stadium, proposed within NEOM and its vertical urban model The Line, holds strong relevance across multiple contemporary research domains, particularly architecture, urban planning, sustainability, and engineering.

1. Vertical Urbanism and Space Optimization

Current research increasingly focuses on high-density cities due to rapid urbanization and land scarcity. The Sky Stadium provides a unique case study of embedding large public infrastructure within a vertical city. It challenges

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traditional horizontal planning by demonstrating how stadiums—typically land-intensive—can be integrated into multi-layered urban systems. This supports research on efficient land use, compact cities, and mixed-use development.

2. Sustainable and Low-Carbon Design
The project aligns with ongoing research into carbon-neutral and energy-efficient infrastructure. The stadium's proposed reliance on renewable energy sources (such as solar and wind), smart climate control, and reduced transportation needs contributes to studies on sustainable building systems. Researchers can examine how such mega-structures can minimize environmental impact while maintaining functionality.

3. Smart City Integration and Technology
As part of a smart city ecosystem, the stadium is relevant to research on digital infrastructure, IoT (Internet of Things), and AI-driven urban management. It exemplifies how large venues can be seamlessly connected to transport, services, and data systems within a smart city framework, offering insights into real-time crowd management, security, and operational efficiency.

4. Mega-Event Infrastructure and Legacy Planning
Its planned use for the FIFA World Cup 2034 makes it significant for research on global sports infrastructure. Scholars study how stadiums can be designed for adaptability, ensuring long-term use beyond single events. This contributes to discussions on economic sustainability, post-event utilization, and urban legacy planning.

5. Advanced Engineering and Construction Techniques
The elevated design introduces new challenges in structural engineering, materials science, and construction logistics. It is relevant to research on high-rise load distribution, modular construction, and innovative materials that ensure safety and durability at extreme heights. It pushes the boundaries of what is technically feasible in stadium design.

III. METHODOLOGY OF PROPOSED SURVEY

The proposed survey on the NEOM Sky Stadium aims to systematically examine its architectural, engineering, and urban planning aspects, as well as its sustainability and technological innovations. The methodology is designed to ensure a comprehensive, structured, and critical review of existing research, reports, and conceptual designs.

1. Objective Definition
The first step is to clearly define the survey objectives:
- To analyze the architectural and structural design of the NEOM Sky Stadium.
- To study its integration within The Line.
- To assess sustainability, energy efficiency, and smart city applications.
- To review challenges, feasibility, and futuristic innovations in vertical stadium design.

2. Literature Collection
Relevant sources are collected from:
- Academic journals, conference proceedings, and technical reports on stadium architecture, urban planning, and sustainable design.
- Official NEOM publications, government reports, and press releases.
- News articles and expert analyses from credible sources.
- Online databases such as Google Scholar, Scopus, and ResearchGate.

3. Selection and Filtering Criteria
The collected materials are filtered based on:
- Relevance to stadium design, urban planning, or sustainability.
- Publication date (recent studies preferred to capture updated designs).
- Credibility of the source (peer-reviewed journals, official statements, or verified news).
- Inclusion of visualizations, technical specifications, or feasibility studies.

4. Classification of Literature
The selected studies and reports are categorized into themes:

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- **Architectural Design:** Structural innovations, vertical stadium concepts.
- **Urban Integration:** Relationship with The Line and smart city planning.
- **Sustainability:** Renewable energy, energy efficiency, and zero-carbon strategies.
- **Engineering Challenges:** Construction feasibility, load-bearing design, and safety.
- **Socioeconomic Implications:** Costs, urban impact, and global event readiness (e.g., FIFA World Cup 2034).

5. Comparative and Analytical Study

The survey performs comparative analysis to:

- Compare NEOM Sky Stadium with other modern and futuristic stadiums globally.
- Examine unique design elements like elevated structures, integration with urban corridors, and sustainability features.
- Evaluate potential challenges in construction, cost, and operational efficiency.

6. Data Synthesis

Insights from the literature are synthesized to:

- Identify recurring design principles and innovative approaches.
- Highlight knowledge gaps and areas where technical feasibility remains uncertain.
- Summarize best practices in vertical stadium construction and urban integration.

7. Identification of Research Gaps

The survey identifies areas needing further investigation:

- Structural feasibility and engineering solutions for elevated stadiums.
- Cost-benefit and economic sustainability analysis.
- Environmental impact studies within a vertical city context.

IV. CONCLUSION

The NEOM Sky Stadium represents a revolutionary approach to stadium design, integrating advanced architecture, engineering, and sustainability within the vertical city framework of The Line. Its elevated structure, futuristic design, and smart city integration highlight a paradigm shift from traditional horizontal stadiums to multi-functional, vertically integrated urban infrastructure.

The stadium is designed to host major events like the FIFA World Cup 2034 while prioritizing renewable energy use, space optimization, and connectivity within the surrounding city. The survey indicates that while NEOM Sky Stadium embodies innovative architectural and technological concepts, there are significant challenges in construction feasibility, cost management, and long-term operational sustainability.

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