Concept of Land Survey for the Kingdom of Saudi Arabia

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Keywords: Land Surveying, National Survey Framework, GEOSA, Vision 2030, Quality Assurance, KSACORS, Cadastral Surveying, FIG, UN-GGIM

Summary:

Land surveying in the Kingdom of Saudi Arabia (KSA) plays a vital role in supporting real estate development, infrastructure expansion, land ownership regulation, and national mapping initiatives. The General Authority for Survey and Geospatial Information (GEOSA) has developed a comprehensive framework for land surveying in the Kingdom, encompassing the precise measurement of distances, angles, and directions; the recording of spatial and subsurface features; and the determination of two- and three-dimensional positions, elevations, and gradients. These activities also include documenting and representing geographic and man-made features through systematic data collection and record preparation.

Various methodologies and instruments are employed depending on the type and purpose of the survey, and accuracy required. These include Global Navigation Satellite System (GNSS) receivers, total stations for line-of-sight measurements, imaging cameras, digital levels for height differentials, and laser scanning devices, among others.

In Saudi Arabia, land surveying is structured around three main components: (1) Engineering Surveys, (2) Topographical Surveys, and (3) Cadastral Surveys. Together, these components establish the foundation for an integrated, regulated, and technologically advanced land surveying sector. This framework enables GEOSA to strengthen governance, improve data quality, and promote institutional collaboration and coordination across the Kingdom. The proposed concept also outlines a strategic roadmap and implementation plan aimed at engaging all relevant stakeholders, facilitating GEOSA's regulatory functions, and ensuring effective monitoring and governance of the surveying sector. The approach is to capacitate the land surveying sector through enabling standards, specifications, quality assurance and surveying calibration facilities. A key objective is the digital transformation of the land surveying sector, as envisaged in the Saudi Vision 2030.

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1. INTRODUCTION

Saudi Arabia is undergoing an unprecedented national transformation under Vision 2030, modernized and grown its urban areas, expanded its infrastructure and diversified its economy, together with scientific and cultural development. This has certainly placed a lot of demands on the various sectors, including the public sector to ensure orderly development and good governance.

This paper aims to establish a comprehensive and unified national concept of land surveying for the Kingdom, defining its structure, governance, quality systems, and implementation mechanisms under GEOSA's mandate as the national geospatial authority.

Land surveying is also critical in the construction and maintenance of infrastructure, such as road and rail networks, high-rise buildings, utilities, water transportation and irrigation, and agriculture. The safety of the public and of infrastructure is enhanced through the precise monitoring of movement of structures and the terrain through precise land surveying measurements. Land surveying is essential for land development, and for securing the real rights in land, through the accurate determination and documenting of the position of land parcel boundaries.

2. BACKGROUND & GLOBAL CONTEXT

Land surveying activities have been performed in the Kingdom of Saudi Arabia (KSA) over many years. However, it was only in the 1950's that land surveying became more organised in the pursuit for oil exploration and medium scale mapping across the country. Various Ministries became progressively involved in land surveying activities in pursuit of their respective mandates. At the same time the private sector became involved in providing land surveying services, mostly to the public sector entities.

No national standards or specifications were available, and so each Ministry was left to its own resources. While national standards for geospatial information recently became available, the first national specification for land surveying only became available when the General Authority of Surveying and Geospatial Information (GEOSA) published the 'Technical Guidelines for Land Surveying' in 2025 (GEOSA, 2025), together with the 'Saudi Arabia National Spatial Reference System Implementation Guidelines' (GEOSA, 2022), together with related documents on the national geodetic survey. This must be taken together with the

'National Geospatial Data Policies and Standards for the Kingdom of Saudi Arabia' (GEOSA, 2023) and 'KSA National Geospatial Feature Concept Dictionary' (GEOSA, 2023).

International experience shows that effective land survey governance requires unified technical standards, strong institutional leadership, national calibration systems, and robust quality assurance mechanisms. Countries such as Australia, Denmark, South Africa, and Malaysia have implemented integrated frameworks combining regulation, digital geospatial platforms, and professional accreditation systems.

Global frameworks such as the UN-GGIM Integrated Geospatial Information Framework (UN-IGIF) and FIG guidelines emphasize consistency, surveyor competency, national reference frames, and data quality—principles directly applicable to the Saudi context.

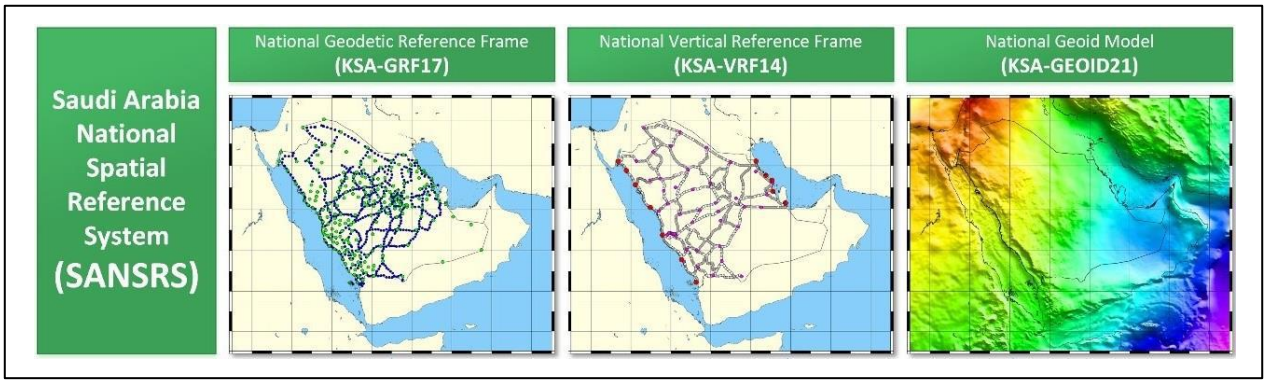

Figure 1: Saudi Arabia Spatial National Refernce System (SANSRS)

3. CURRENT STATUS OF LAND SURVEYING IN KSA

Cadastral surveys demarcate the extent of rights in land, through the measurement of the cadastral boundaries, the recording of the position of the rights in land, and matters related thereto.

Rights in land are demarcated by cadastral boundaries of the cadastral land parcel to which the rights apply. All cadastral boundaries are unambiguously defined and accurately measured to ensure that the rights in land are clearly delimited, with the objective of minimizing disputes over the rights in land. This provides for increased security of land tenure. This in turn provides for improved ability to raise finances, using the land rights as security.

With regard to cadastral surveying, there currently is no national cadastral survey system, with only about 60% of the country with recorded cadastral survey documents. Previously, rights in land (rights in *rem*) were recorded on a title deed, which was then lodged with the local magistrate's office. The title deed did not have clear dimensions or location of the land parcel boundaries. This resulted in uncertainty of the extent and location of the right in land – uncertain land parcel boundaries. Any change of ownership in land or other registration of rights or settlement of any land parcel boundary dispute is decided in a court of law, which takes a

minimum of 120 days and often a few years, and is deemed to be a difficult process. With the commencement of the Law of Real Estate Registration (Royal Decree No. M/6, 2024), the situation has changed with the creation of the Real Estate General Authority (REGA), for those land parcels that fall within the designated real estate areas. These areas are mostly found in the urban areas, and do not cover the whole country.

Land surveying in the KSA is conducted across multiple government entities and semi-governmental sector organizations, supporting diverse national projects. However, current challenges include:

- Surveys based on previous geodetic reference systems;
- Variations in survey practices and methodologies;
- Absence of a unified national survey manual;
- Inconsistent accuracy classifications;
- Variable professional competency levels;
- Limited systematic QA/QC field verification;
- Fragmented cadastral survey workflows.

GEOSA plays a central role in addressing these challenges through regulation, licensing, standardization, and national coordination.

4. PROPOSED NATIONAL CONCEPT OF LAND SURVEYING

The proposed national concept defines land surveying in KSA across three core domains:

4.1 Engineering Surveying

Supporting infrastructure development, utilities, construction projects, deformation monitoring, and major national developments.

4.2 Topographic Surveying

Providing terrain mapping, natural and man-made feature capture, digital elevation models, and 3D geospatial products. The recording of the 3D position of near-underground infrastructure, in particular utilities, is included.

4.3 Cadastral Surveying

Supporting land registration, land parcel boundary definition, land parcel boundary relocation, land tenure security, and integration with national cadastral and mapping systems.

Key pillars of the concept include:

- National geodetic reference frame, SANSRS, based on KSA-CORS;
- Unified national survey specifications;

- Licensing and classification of surveyors and companies performing surveying work;
- Digital submission and validation of survey data, using Agentic AI;
- National Survey Manual and accuracy classification system;
- Quality assurance (QA) based on Total Quality Management (TQM) principles.

5. REGULATORY & INSTITUTIONAL FRAMEWORK

GEOSA's regulatory framework includes:

- Development and approval of technical standards and specifications;
- Licensing and classification of surveyors and surveying companies;
- Professional competency requirements;
- Field inspection, audit, and quality compliance enforcement;
- Governance of national geospatial datasets;
- Inter-agency coordination with municipalities, ministries, and utilities.

This framework ensures consistency, accountability, safety, and high-quality spatial data production across the Kingdom.

6. QUALITY ASSURANCE & CALIBRATION FRAMEWORK

A national QA system, based on ISO 9000 suite of standards, is essential to ensure the reliability and defensibility of survey outputs. The framework includes:

- Quality compliance auditing, including field auditing and verification procedures;
- Accuracy classes for engineering, topographic, and cadastral surveys;
- GNSS quality monitoring through KSA-CORS;
- Calibration of survey instruments, via national calibration facilities;
- Mandatory reporting of deviations;
- Continuous professional development requirements.

This approach aligns with FIG recommendations, ISO 191xx standards, and international GNSS best practices.

7. DIGITAL TRANSFORMATION

Digital Transformation is a core strategy of the Saudi Vision 2030, to build a diversified, knowledge-based economy by modernizing government, and fostering a vibrant digital society. GEOSA is responding to this call by placing digital transformation at the center of its strategic planning, growth and investment.

The main objectives of the digital transformation in land surveying being to:

a) Improve efficiencies in processes by using artificial intelligence (AI), specifically the use of AI agents to automate processes, to the fullest extent possible;

b) Provide for seamless operations between the field and the office;

c) Use surveying instrumentation that include elements of, or total, robotics and recording of measurements, to speed up processes, improve productivity, reduce the personnel numbers in the survey team, reduce human error, and for applications in hazardous areas.

Land surveying processes and standard operating procedures (SOPs) should be reviewed and adapted to incorporate AI agents and robotics wherever appropriate to achieve the objectives of digital transformation. With the rapid advances in digital technologies, these processes and SOPs will need to be reviewed on a regular basis. These AI agents must be developed by technical persons who are experts in the field of land surveying to ensure the correctness of the models used.

On the technological side, a number of surveying instruments, including associated sensors, already exist that contain elements of robotics, and the automated recording of measurements and other observations. Such instruments are advancing in capability all of the time. In particular, the surveying instruments, with associated sensors, and using the approved processes and SOPs, provide for the seamless office-field environment. This will improve efficiency levels, reduce errors or oversight, make the surveyor in the field to be well connected to the office, thus providing access to all required information to complete the field survey task, and enhancing the safety of the field surveyor.

Ultimately, this digital transformation will further the objectives of the Vision 2030, and beyond.

8. IMPLEMENTATION ROADMAP (2026 – 2030)

The national roadmap is structured into four phases:

Phase 1 (2026) – Foundation

- Development of national survey specifications.
- Establishment of updated standards and manuals.
- Definition of licensing requirements.

Phase 2 (2026–2027) – Enablement

- Launch of QA audit programs.
- Implementation of national calibration systems.
- Establishment of surveyor accreditation frameworks.

Phase 3 (2028–2029) – Digital Transformation

- Deployment of a National Survey Digital Platform

- Integration of KSA-CORS into operational workflows.
- Full digital submission and validation of survey data.

Phase 4 (2030) – Sustainability

- Performance monitoring through KPIs.
- Periodic updating of standards.
- Long-term capacity-building and training programs.

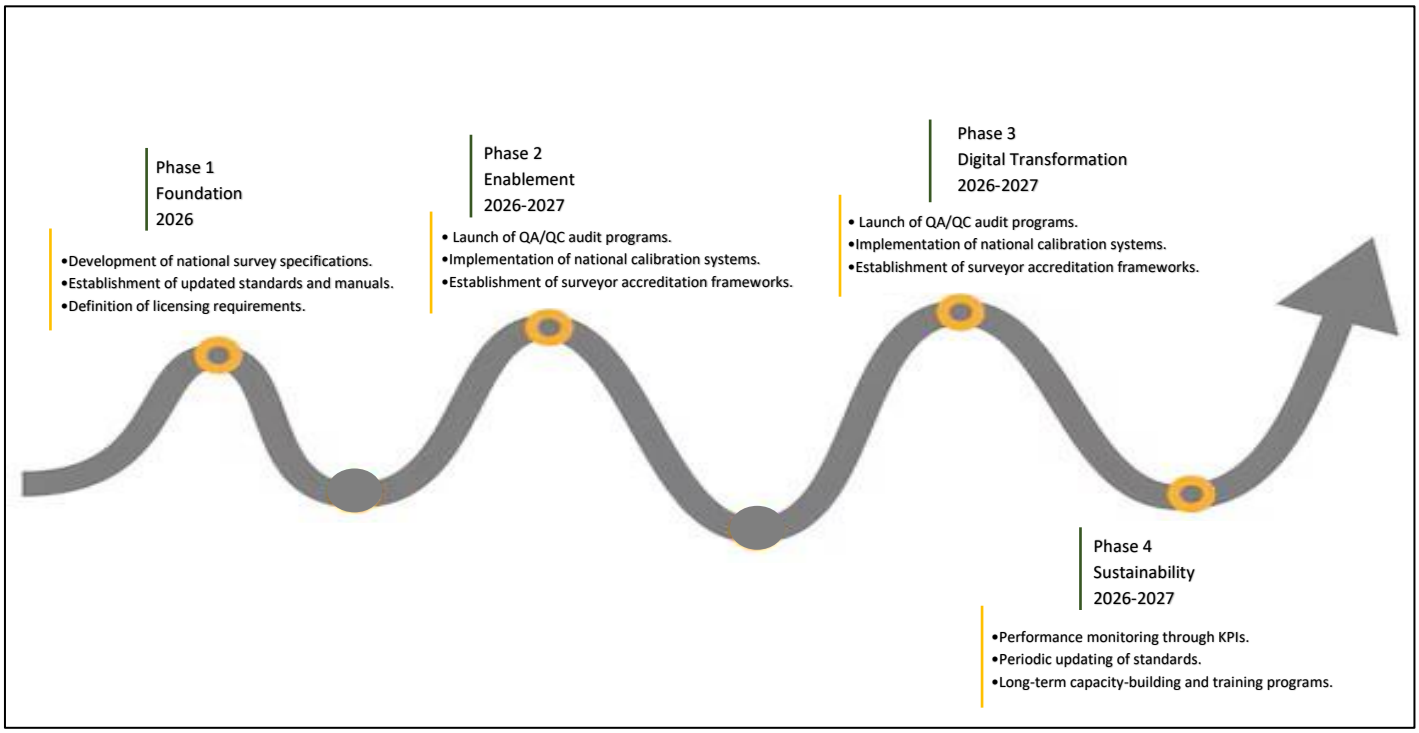

Figure 2: Implementation Roadmap (2026 – 2030)

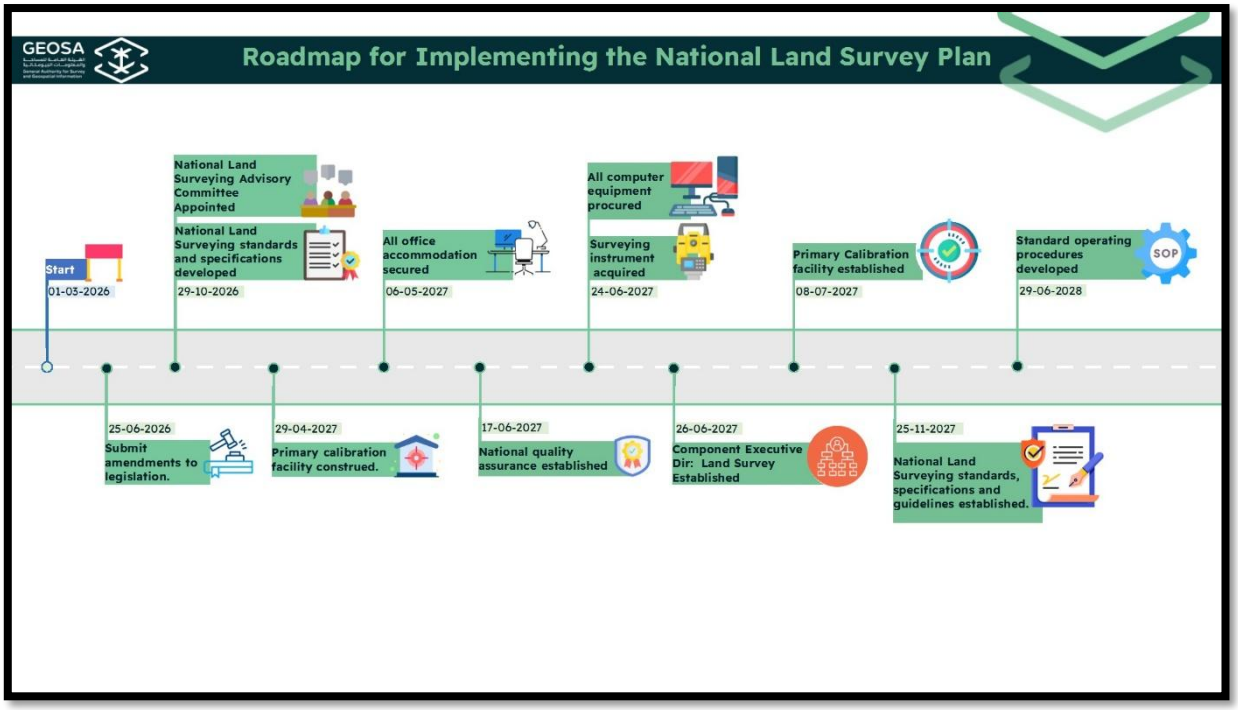

Figure 3: Roadmap of the national Land Survey plan

9. EXPECTED OUTCOMES AND IMPACT

The unified national land survey concept will deliver:

- Harmonized surveying practices nationwide;
- Improved accuracy, reliability, and data consistency;
- Faster and more efficient project delivery;
- Transparent and accountable cadastral processes;
- Strong support for smart cities and infrastructure;
- Alignment with Vision 2030, SDGs, and global standards.

10. CONCLUSION AND WAYFORWARD

This paper presents a comprehensive national concept of land surveying for the Kingdom of Saudi Arabia, establishing a robust regulatory, technical, and institutional framework. The proposed roadmap supports digital transformation, quality assurance, and sustainable development.

Successful implementation requires strong stakeholder collaboration, consistent enforcement, and continuous alignment with international standards, positioning Saudi Arabia as a regional leader in modern land survey governance.

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ISO 191xx Series – Geographic Information Standards
IGS / UNAVCO – GNSS Best Practices
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