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Nova Cognitive Assessments
for
Tharwah

Rationale & Literature Review
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Introduction

The Nova Cognitive Ability Suite is a modern, adaptive set of cognitive assessments developed by Tharwah, a leading talent solutions provider in the Kingdom of Saudi Arabia. It is the first cognitive test suite co-developed in both Arabic and English, designed for global relevance while offering strong cultural alignment with the Gulf Cooperation Council (GCC) region. Rather than translating legacy Western tools, the Nova suite was purpose-built to reflect local language, educational contexts and workforce expectations, while maintaining full compliance with international psychometric standards.

The Nova cognitive assessments were developed with two core priorities in mind: first, to ensure **relevance to the future of work**, particularly in an era shaped by AI, automation, data-driven decision-making and increasing role complexity; and second, to provide **scalable, secure and adaptive tools** for use across public and private sector organisations throughout the GCC and internationally. The assessments align with a growing emphasis on human intelligence as a differentiator in technologically augmented work settings—echoing themes from reports such as the World Economic Forum’s *Future of Jobs* (2020, 2023), which highlight the enduring importance of analytical thinking, reasoning and complex problem-solving.

Grounded in over a century of research on general mental ability (g) and domain-specific aptitudes, the Nova suite measures three core domains: Verbal Reasoning, Numerical Reasoning and Abstract Reasoning. These domains have been recognised in academic and applied literature as among the strongest predictors of job performance, leadership potential and trainability (Schmidt & Hunter, 1998; Gottfredson, 2002). Each test is adaptive, mobile-ready and includes AI-resistant design features, providing a future-proof approach to fair and valid cognitive measurement of candidates.

From a design and delivery perspective, the Nova suite is:

- **Modernised for digital delivery** with adaptive algorithms and multimedia-based items to reduce to deliver an engaging candidate experience and enhance accessibility across platforms.
- **Culturally and linguistically grounded** with parallel development in Arabic and English, ensuring semantic equivalence and relevance to local workplace settings.
- **Right-sized for decision-making** with 45 items per test domain, with each administered in 12–15 minutes using real-time adaptive scoring to maximise precision and candidate engagement.
- **Scientifically validated** drawing on modern psychometric approaches including Item Response Theory (IRT) to ensure measurement accuracy and defensibility.
- **Secure by design** featuring dynamic item rotation, video-based verbal content and behavioural monitoring to counter the risks posed by generative AI tools.
- **Aligned with long term vision** to support workforce transformation agendas such as Saudi Vision 2030 and other GCC vision statements by identifying cognitive agility and future leadership potential.

The Nova cognitive suite is intended for use in both selection and development contexts—ranging from graduate recruitment to executive assessment. It integrates seamlessly with broader talent strategies, offering insight not only into general ability but also into specific cognitive strengths that align with organisational competency frameworks, role requirements and emerging skill taxonomies.

As part of the broader Nova assessment platform, the cognitive suite provides a scientifically grounded foundation for talent decisions in the GCC and beyond—offering an agile, inclusive and future-focused approach to measuring what matters most in today’s and tomorrow’s workplaces.

Rationale & Theoretical Foundations

This section outlines the theoretical foundations that shape the Nova Cognitive Ability Suite. Drawing on over a century of intelligence research from early psychometric models to contemporary theories of general mental ability (*g*) and its constituent elements, the suite brings cognitive assessment into alignment with the demands of the modern and future workplace.

Each of the three core domains of Numerical Reasoning, Verbal Reasoning and Abstract Reasoning has been selected for its strong empirical links to workplace performance, learning agility and leadership potential. These domains reflect cognitive capacities that underpin emerging workforce capabilities such as analytical thinking, innovation, adaptability and digital decision-making.

The following sections unpack each reasoning type, drawing on psychological theory and applied research to explain their relevance in real-world settings. Their specific connection to strategic competencies and national transformation agendas across the GCC is also outlined, ensuring regional and global applicability.

Nova Numerical

Numerical reasoning relates to the ability to interpret, analyse and draw logical conclusions from numerical information and remains a cornerstone of cognitive ability assessment and workplace success. Contrary to speculation that this form of intelligence is being superseded by artificial intelligence (AI), its relevance in the modern workplace, particularly in the data-rich environments fostered by AI, has only increased (Hunter & Schmidt, 2004; Kuncel, Hezlett, & Ones, 2004). The rising demand for roles requiring data literacy and analytical acumen underscores this point, making numerical reasoning an essential capability for leaders, managers and emerging talent across sectors.

AI systems have enhanced the volume and accessibility of data but have not replaced the need for human oversight, interpretation and critical thinking. Numerical reasoning tests capture the extent to which individuals can make sense of structured information, perform accurate calculations and interpret quantitative trends. These abilities are key in contexts where decisions must be grounded in evidence and financial, operational or strategic judgments are routine (Gottfredson, 2002).

In this context, numerical reasoning remains a key predictor of job performance, especially when combined with verbal and abstract reasoning. Kuncel et al. (2004) found that general cognitive ability, particularly when comprising multiple reasoning domains, predicted up to 40% of the variance in job performance. The GCC countries ambitions to become data-driven knowledge economies, as articulated in national strategies like Saudi Arabia's Vision 2030 and the UAE's Centennial Plan 2071, make the identification of numerically literate talent a strategic imperative.

Many emergent sectors will depend on leaders and managers who can navigate complex datasets and make decisions based on sound numerical judgment. Numerical reasoning is therefore critical not only for technical roles but also for policy-makers and administrators tasked with strategic resource allocation, cost-benefit analyses and the evaluation of performance metrics (Deary, Strand, Smith, & Fernandes, 2007).

From a psychometric standpoint, numerical reasoning tests demonstrate high internal reliability and construct validity across cultural settings (Carroll, 1993), making them appropriate for use in the GCC's multicultural workforce. Moreover, the modern assessment format including adaptive testing and mobile delivery, enables secure use at scale. The current suite of cognitive assessments, developed in both Arabic and English, applies

an adaptive architecture within each item bank. This ensures the assessments remain psychometrically robust while also offering an engaging user experience that is compatible with contemporary recruitment needs.

In conclusion, numerical reasoning remains a vital predictor of workplace performance and leadership potential, with particular relevance in the GCC's rapidly evolving knowledge economy. It supports the strategic priorities of governments in the region while mitigating the risk of over-reliance on automated decision-making.

Nova Verbal

Verbal reasoning is the capacity to comprehend, analyse and evaluate written information. This is a core pillar of cognitive functioning and workplace competence, particularly within leadership, policy and communication-intensive roles. As modern organisations increasingly demand clarity of thought, persuasion and cross-cultural fluency, verbal reasoning offers a vital measure of how individuals interpret complex text-based and spoken information, extract meaning and apply logic to language. This has particularly relevant where clarity in communication, diplomacy and document interpretation is integral to effective administration (Ree & Earles, 1991; Schmitt et al., 2007).

Unlike language proficiency or knowledge-based assessments, verbal reasoning directly measures linguistic processing, assessing a person's ability to work with unfamiliar material and discern logical relationships within text. This makes it highly relevant for both native and non-native English or Arabic speakers operating in the multicultural professional settings across the GCC (Furnham, 2008). It has been shown to correlate significantly with general intelligence (g) and predictive validity studies consistently associate verbal reasoning with strong performance in leadership, managerial and graduate-level roles (Schmidt & Hunter, 1998; Kuncel, Hezlett, & Ones, 2004). In government contexts, verbal reasoning enables leaders and policymakers to engage with complex legislation, policy drafts and cross-sector communications, while ensuring conceptual clarity and accurate synthesis of competing viewpoints.

From a psychometric and operational standpoint, verbal reasoning assessments remain among the most valid and efficient tools for large-scale talent identification. They demonstrate high internal consistency and are resistant to coaching or test familiarity effects (Carroll, 1993; Schmitt et al., 2007). In the current cognitive suite, verbal reasoning is delivered via captioned video rather than static text, an innovation aimed at minimising AI-driven cheating and enhancing accessibility for mobile and tablet-based testing environments. This medium also allows for richer linguistic and contextual processing, enabling the assessment of nuanced comprehension and interpretation beyond surface-level literacy.

As with other domains in the cognitive suite, verbal reasoning tests are designed using culturally neutral, work-relevant scenarios. Each test includes a rotating item bank of more over 45 questions and is presented adaptively, allowing real-time calibration of difficulty based on the respondent's performance. With a completion time of 12 to 15 minutes, the assessment balances both efficiency and rigour.

In sum, verbal reasoning remains a powerful predictor of professional success, particularly in leadership and governance roles that require high levels of analytical communication. Its inclusion in the assessment suite with modernised video-based items ensures a forward-facing, linguistically rigorous approach to identifying cognitive talent.

Nova Abstract

Abstract reasoning, also sometimes referred to as logical or inductive reasoning, measures an individual's ability to discern patterns, identify relationships and solve novel problems without reliance on prior knowledge. It is a core element of fluid intelligence, the ability to think flexibly and solve problems in new situations (Carroll, 1993; Sternberg, 1985). In today's knowledge-driven and rapidly evolving work environment, particularly within the ambitious transformation agendas of the GCC countries, abstract reasoning is increasingly recognised as a foundational cognitive capability for leaders, innovators and strategists.

The relevance of abstract reasoning has intensified in an era dominated by volatile, uncertain, complex and ambiguous (VUCA) conditions. As government entities and private sector organisations within the GCC region pursue diversification, digitisation and technological advancement, leaders are frequently required to make sense of ill-defined problems, synthesise multiple sources of information and adapt strategies dynamically. Abstract reasoning facilitates this type of thinking, enabling individuals to spot trends and patterns, extrapolate solutions and innovate in the absence of complete data (Deary, Penke, & Johnson, 2010).

Recent research affirms the predictive power of abstract reasoning for professional success. Kuncel, Hezlett and Ones (2004) reported that abstract reasoning, when included in multidimensional cognitive assessments, contributes significantly to the prediction of job performance and leadership effectiveness. This is particularly evident in roles that require systems thinking, strategic foresight and scenario planning, all competencies identified in national development strategies across the GCC.

Abstract reasoning is also widely valued for its cross-cultural fairness. Because it relies on visual patterns and non-verbal stimuli, it reduces linguistic and educational biases, which is especially important in the diverse labour markets of the GCC region. It aligns with the principle of equitable assessment, supporting fair identification of potential across nationalities and demographic backgrounds (Carroll, 1993; Deary et al., 2007).

The assessment format employed reflects global best practices. With a bank of visual reasoning items presented in adaptive blocks, the test dynamically adjusts to candidate ability, improving measurement precision while maintaining candidate engagement. Each test, designed for digital delivery across devices, takes approximately 12–15 minutes to complete, offering a scalable and inclusive assessment solution.

In summary, abstract reasoning provides a rigorous, culturally neutral method for identifying high-potential individuals capable of strategic thought and innovation. As GCC nations strive to foster globally competitive knowledge economies, abstract reasoning is an essential metric for evaluating the capacity to solve problems in the context of complexity, ambiguity and change.

Test Development Approach

The cognitive assessment suite was developed as part of the Nova assessment suite, a region-first initiative tailored specifically for the GCC. Designed by experienced occupational psychologists and psychometricians, the suite was built to international standards while addressing the cultural, linguistic and strategic workforce needs of the region. Its purpose is to offer scientifically rigorous tools for high-stakes decision-making in recruitment, talent development and succession planning across graduate, professional and leadership levels.

The development methodology combined Classical Test Theory (CTT) and Item Response Theory (IRT), consistent with best practice in modern psychometrics (Embretson & Reise, 2000; Hambleton, Swaminathan, & Rogers, 1991). Each of the three reasoning domains was supported by a dedicated item development process that generated sets of initial items, from which the best-performing 45 items per test were selected based on empirical item functioning.

Items were constructed to reflect real-world, work-relevant scenarios while maintaining neutrality across gender, nationality and linguistic background. All items were authored simultaneously in English and Arabic using parallel development processes rather than direct translation—ensuring semantic and conceptual equivalence. This approach is in line with cross-cultural test design recommendations (van de Vijver & Tanzer, 2004), ensuring content relevance and fairness across the multilingual workforce of the GCC.

The item review process involved blind evaluation by independent reviewers to verify clarity, cultural appropriateness and cognitive complexity. Piloting was conducted on a sample of 300 respondents drawn from the target population of graduates, professionals and mid-level managers. Psychometric evaluation included item-total correlations, response distributions, distractor functioning and model fit under the 2-parameter logistic (2PL) and 3PL IRT models, where applicable.

Only items demonstrating high discrimination, appropriate difficulty targeting and minimal differential item functioning (DIF) were retained. The final item banks for each reasoning domain were constructed to support computerised adaptive testing (CAT), enabling real-time estimation of ability levels while maintaining both test efficiency and precision (Weiss, 1982; van der Linden & Glas, 2010).

Tests are designed to be completed in 12 to 15 minutes per domain, with each candidate receiving a dynamically generated set of items based on their response pattern. This adaptive structure minimises test fatigue, enhances engagement and offers psychometric efficiency with fewer items than fixed-form equivalents (van der Linden, 2005).

The output provides domain-specific scores numerical, verbal and abstract reasoning consistent with the hierarchical models of intelligence described by Carroll (1993). Reports are available in both candidate-facing and manager formats, supporting feedback, development and talent decisions.

In summary, the Nova cognitive ability suite exemplifies rigorous test construction, combining modern psychometric models with contextual sensitivity. It aligns with international standards while setting a new regional benchmark for cognitive assessment in the Arab world.

Ensuring Test Security

As generative artificial intelligence (GenAI) technologies such as ChatGPT, Gemini, Copilot and others become increasingly capable of solving traditional assessment tasks, test security has become a critical concern in psychometric design. To maintain the validity and fairness of cognitive testing in this new landscape, the Nova cognitive suite has embedded security measures specifically engineered to mitigate risks associated with unauthorised AI use.

This is particularly important in cognitive ability testing, where even modest external assistance can significantly alter score validity, thereby undermining the predictive power of the assessment (Steger, Schroeders, & Wilhelm, 2023). The Nova suite responds to this threat with innovations in test design, delivery and behavioural data monitoring.

Secure Item Formats: One of the most significant innovations is the use of captioned video formats for verbal reasoning items, rather than static written passages. These multimedia items are delivered via short, subtitled video clips and are not easily transcribed, copied or interpreted by text-based AI models. This delivery mode enhances the ongoing validity of the items and limits the feasibility of AI-enhanced assistance by candidates in real-time. It also reflects current work environments where multimodal communication and comprehension are critical.

Adaptive Testing Architecture: The use of computerised adaptive testing (CAT) across all three domains (numerical, verbal and abstract) further strengthens test security. Each candidate receives a unique, dynamically generated sequence of items tailored to their ability level. This not only improves measurement precision but significantly reduces the risk of memorising items, sharing of answers or collaboration between candidates (van der Linden & Glas, 2010). The item pool is deliberately broad, with 45 high-performing items per domain selected based on IRT parameters and piloted response behaviours.

Device-Agnostic Digital Controls: Tests are designed to be completed on desktop, tablet, or mobile devices, but delivered through a secure, locked-down browser environment when required. This restricts navigation to external apps or browser tabs and disables cut/paste functions. Where necessary, remote proctoring can be layered on top of the test engine to support high-stakes applications.

Response Behaviour Monitoring: In addition to secure delivery, the system monitors real-time behavioural data including response latency, scrolling patterns and time taken on individual items. Unusual patterns such as excessively fast completion of complex items, extended pauses or identical response sets can be flagged for post-hoc analysis. Such behavioural forensics have been shown to be a useful tool in detecting response anomalies and test misuse (Kingston, Tiemann, & Bejar, 2019).

Ethical and Fair Design Principles: Security innovations are deployed in a manner that does not compromise the fairness or accessibility of the test. All item content is culturally neutral and workplace-relevant, with interface design has been optimised for clarity and usability. Security is thus layered in a way that protects validity without introducing differential barriers to entry. The assessment can also be used in an integrated way with the Nova Personality Questionnaire to ensure a rounded assessment of individuals to maximise fairness when supporting talent decisions (Woods & Patterson, 2023).

In summary, the Nova suite integrates next-generation test security protocols to ensure that candidate scores reflect authentic cognitive ability and not artificial augmentation. In doing so, it provides defensible, high-integrity data for talent decisions in an era where digital assessment is both essential and increasingly under threat.

Linkage to Nova Competency Framework

The Nova cognitive assessment suite is intentionally aligned with the Nova Competency Performance Architecture, an integrated behavioural framework designed to reflect the demands of modern organisational life and the strategic priorities of the GCC. As organisations across the region transition toward digital economies and adopt ambitious transformation visions (e.g. Saudi Vision 2030), there is an increasing need to measure not just what people know, but how they think, reason and adapt under pressure.

Cognitive ability as measured through verbal, numerical and abstract reasoning underpins many of the 40 competencies in the Nova model. For example, the domain of Analytical Thinking is directly supported by an individual's performance on abstract and numerical reasoning tasks, which assess the capacity to deconstruct complex information, identify patterns and draw valid conclusions. Similarly, competencies such as Data-Driven Decision Making, Process Optimisation and Economic Acumen are informed by strong numerical reasoning skills that enable individuals to make accurate, evidence-based judgments.

The Verbal Reasoning component of the Nova suite contributes directly to competencies like Intelligent Communication, Persuades & Influences and Conflict Resolution, which require individuals to comprehend complex ideas, construct logical arguments and communicate effectively across diverse stakeholder groups. This is especially relevant in multilingual and multicultural work environments typical of the GCC region.

In addition, Abstract Reasoning aligns with forward-looking competencies such as Strategic Agility, Envisioning the Future, Fosters Innovation and Smart Planning. All of these depend on an individual's capacity to synthesise disparate information, anticipate change and generate novel solutions. These high-order capabilities become increasingly important in leadership roles where adaptability and systems thinking are essential.

Crucially, this suite improves on earlier generations of cognitive testing by directly mapping to modern, behavioural competencies. Older tests often measured reasoning in abstract isolation, with limited applicability to the evolving demands of contemporary roles. By contrast, the Nova suite was designed alongside a modernised view of the world of work, ensuring that each domain reflects the cognitive demands of real-world performance. The inclusion of additional security measures and video-based verbal items further modernises the test format, enhancing its relevance to current work environments and technological realities.

The suite also aligns with emerging skills taxonomies, such as those used in public sector workforce planning or by global frameworks like ESCO (European Skills, Competences, Qualifications and Occupations) and the World Economic Forum's Skills of the Future. For example, verbal reasoning aligns with skills such as comprehension, summarisation and professional writing. Numerical reasoning maps to statistical thinking, data interpretation and quantitative problem-solving. Abstract reasoning aligns with systems thinking, pattern recognition and innovation. This alignment allows organisations to integrate cognitive results into broader talent analytics platforms and workforce capability maps.

The model also includes Applying AI in Practice which is supported by these all three reasoning domains. Verbal reasoning supports interpretation of AI-generated content; numerical reasoning aids in analysing data outputs, and abstract reasoning helps users think through workflows and automation strategies. This reflects the emerging reality that future-ready competencies must combine digital fluency with human judgement.

Cognitive Domain	Mapped Nova Competencies	Why These Competencies Align
Verbal Reasoning	Intelligent Communication, Conflict Resolution, Persuades & Influences, Empathic Leadership, Active Listening	These competencies require the ability to understand, analyse and communicate complex verbal information across diverse audiences and contexts.
Numerical Reasoning	Data-Driven Decision Making, Analytical Thinking, Economic Acumen, Process Optimisation, Strategic Talent Management	These rely on data interpretation, evidence-based judgement and numeracy in decision-making skills measured directly by numerical reasoning.
Abstract Reasoning	Complex Thinking, Strategic Agility, Smart Planning, Fosters Innovation, Envisioning the Future	These involve pattern recognition, systems thinking, strategic foresight and conceptual reasoning, which are core to abstract reasoning tasks.

In conclusion, the Nova cognitive suite strengthens measurement of the Nova Competency Model by providing a foundational layer of insight that supports accurate, fair and future-focused talent decisions. It ensures that organisations can identify those who not only demonstrate behaviours aligned with strategic competencies, but who also possess the underlying cognitive agility and potential to develop, adapt and thrive in increasingly complex roles.

Nova Trait Mapping to GCC National Visions

Summarising many of the observations made earlier in this literature review, the table below outlines the direct linkage of each of three cognitive assessments to both the Saudi Arabia Vision 2030 and broader transformation agendas across other GCC countries including the UAE, Qatar, Oman, Kuwait and Bahrain.

Domain/Trait	Connection to Saudi Vision 2030	Connection to Other GCC Visions
Verbal Reasoning	Supports communication clarity in government, diplomacy and policy development; essential for enhancing education and citizen engagement	Enables future-ready leadership with high-level communication and multilingual public engagement
Numerical Reasoning	Critical for economic diversification, digital economy roles, financial stewardship and data-driven governance	Supports AI integration, fiscal policy design and evidence-based public sector modernisation
Abstract Reasoning	Essential for innovation, foresight and adaptability within national planning and AI strategy initiatives	Aligns with strategic foresight, innovation and smart government services planning

Summary

The Nova Cognitive Ability Suite represents a modern, regionally relevant and scientifically grounded approach to cognitive assessment. Developed in both Arabic and English and aligned with international psychometric standards and best practice, it offers a future-ready solution for identifying talent and understand potential in an increasingly complex and technology-driven world of work. By measuring core domains of verbal, numerical and abstract reasoning, the suite provides deep insight into an individual's capacity for analysis, decision-making, strategic thinking and adaptability.

What sets Nova apart is its deliberate integration with the Nova Competency Model, ensuring that cognitive insights are directly relevant to observable workplace behaviours. From data-driven decision-making and intelligent communication to strategic agility and innovation, the assessment connects cognitive performance with the traits and skills most valued in high-impact roles.

Crucially, the tool is designed for practical deployment with it's adaptive format, security against AI misuse and accessibility across devices. It is well positioned to support national transformation agendas across the GCC, including Saudi Vision 2030 and beyond, by helping organisations identify, develop and future-proof their workforce. In a time when human intelligence is more vital than ever, the Nova ability suite offers organisations both confidence and capability to in making the most critical talent decisions.

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