

# Evolution of Scientific Arabic: A Comprehensive Linguistic Analysis of Modern Lexicography

Published: March 14, 2026 | Index ID: #967

The evolution of scientific discourse in Modern Standard Arabic (MSA) represents one of the most complex linguistic transitions in the history of Semitic languages. As technological advancements accelerated throughout the 20th and 21st centuries, the Arabic language faced an unprecedented challenge: bridging the gap between its classical roots and the rapid-fire nomenclature of Western scientific innovation. This challenge was meticulously documented in the seminal work by Abdul Sahib Mehdi Ali, "**A Linguistic Study of the Development of Scientific Vocabulary in Standard Arabic**," which serves as the foundational text for this analysis. The study explores how a language with a rigid morphological structure adapts to the fluid, ever-changing demands of global science and technology.

## 1. Theoretical Framework: The Morphological Engine of Arabic

To understand the development of scientific vocabulary, one must first grasp the **Root-and-Pattern** system of Arabic. Unlike Indo-European languages that often rely on compounding or agglutination, Arabic utilizes a highly systematic internal derivation process. Most Arabic words are derived from a triliteral root (composed of three consonants), which provides the core semantic meaning. By applying various morphological patterns (*awzan*), the language generates specific nouns, verbs, and adjectives related to that core concept.

### 1.1 Lexical Expansion Strategies

Linguists identify several primary mechanisms through which scientific Arabic has expanded its lexicon:

- Ishtiqaq (Derivation):** The process of extracting new words from existing roots using established patterns. For example, the root K-T-B (writing) generates *Maktaba* (library) and *Maktub* (written).
- Qiyas (Analogy):** Extending existing grammatical and morphological rules to create new terms for modern concepts.
- Majaz (Metaphorical Extension):** Attributing new, technical meanings to ancient words. A classic example is the word *Sayyarah*, which originally referred to a caravan but is now the standard term for an automobile.
- Ta'rib (Arabization):** The phonological adaptation of foreign words into Arabic script and sound systems, such as *Tilifizyun* (television) or *Tiknulujya* (technology).
- Naht (Compounding/Blending):** While less common in Arabic than in English, this involves merging two words to form a new technical concept, such as *Kahrumaqratisiyah* (electromagnetic).

## 2. Technical Analysis of Terminological Methodologies

The development of scientific vocabulary is not a random occurrence but a governed technical process often overseen by Language Academies (*Majami' al-Lughah al-'Arabiyyah*) in Cairo, Damascus, and Baghdad. These institutions prioritize certain methods over others to maintain the linguistic integrity of MSA while ensuring functional utility.

### 2.1 Comparison of Methods in Technical Translation

The following table evaluates the efficacy and frequency of various terminological methods used in modern scientific Arabic:

| Method                | Linguistic Purity | Clarity/Precision | Ease of Adoption | Common Application                            |
|-----------------------|-------------------|-------------------|------------------|-----------------------------------------------|
| Derivation (Ishtiqaq) | High              | High              | Moderate         | Core scientific concepts (Physics, Chemistry) |
| Metaphor (Majaz)      | High              | Moderate          | High             | General technology, Aerospace                 |
| Arabization (Ta'rib)  | Low               | Very High         | Very High        | Medical, Pharmacology, IT                     |
| Blending (Naht)       | Moderate          | High              | Low              | Complex engineering, Mathematics              |

### 3. Core Mechanics: The Role of 'Awzan' in Science

In his study, Abdul Sahib Mehdi Ali highlights the **semantic load** of specific patterns. In scientific Arabic, certain patterns are systematically reserved for specific categories of meaning. For example:

- Fa‘alah: Often used for instruments and machines. Thallajah (refrigerator), Ghasalah (washing machine), Tayyarah (airplane).
- Fi‘alah: Used for professions or systematic fields. Zira‘ah (agriculture), Sina‘ah (industry).
- Fa‘lan: Often denotes a state of intensity or movement, occasionally utilized in describing chemical reactions.

#### 3.1 Case Study: The Evolution of Computing Terminology

The computing revolution provides a perfect case study for lexical development. Initially, many terms were simply transliterated (e.g., *Kumbyutar*). However, through the efforts of the Arabization Bureau, more native terms were derived:

- Hasiub (Computer): Derived from the root H-S-B (to calculate), following the pattern Fa‘ul, which denotes an intensive agent.
- Shabakah (Network): Originally meaning a net or lattice, extended metaphorically to encompass digital infrastructures.
- Barnamaj (Program): A loanword from Persian that has been fully integrated and now generates its own derivatives like Mubarmif (programmer).

### 4. Procedural Workflow for Standardizing Scientific Terms

Standardizing a scientific term in Arabic follows a rigorous technical workflow to ensure consistency across the 22 Arabic-speaking nations. This process is essential for education and technical documentation.

#### Step 1: Concept Analysis

Linguists and subject matter experts (SMEs) analyze the foreign term's etymology, its function, and its relationship to other terms in the same field. They determine if the term describes a process, a tool, or a theoretical state.

#### Step 2: Searching the Classical Lexicon

The first preference is always to find a dormant word in classical Arabic dictionaries (such as *Lisan al-Arab*) that can be revived or repurposed through **Majaz**.

### Step 3: Morphological Derivation

If no classical equivalent exists, linguists attempt to map the concept to a trilateral root and apply a productive pattern (**Ishtiqaq**). This ensures the new word "feels" Arabic and follows the language's internal logic.

### Step 4: Controlled Arabization

If the term is a proper noun (like a chemical element) or if a derived term would be too cumbersome, the word is Arabized (**Ta'rib**). This involves adjusting the phonemes to fit Arabic phonology (e.g., replacing 'P' with 'B' or 'V' with 'F').

## 5. Challenges and Failure Modes in Lexical Development

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Despite the systematic approach, several challenges hinder the development of scientific Arabic. Abdul Sahib Mehdi Ali's research suggests that the speed of Western innovation often outpaces the bureaucratic speed of Language Academies.

### 5.1 The Issue of Synonymous Fragmentation

One of the primary failure modes is the lack of coordination between different regional academies. This leads to **terminological fragmentation**, where three different words might be used for "Software" in Cairo, Damascus, and Rabat. This inconsistency complicates technical education and scientific publishing.

| English Term | Regional Variation A | Regional Variation B | Standardized Attempt |
|--------------|----------------------|----------------------|----------------------|
| Software     | Barmajjiyyat         | Al-A'mal al-Lina     | Barmajjiyyat         |
| Mobile Phone | Jawwal               | Mahmul               | Hatif al-Khallawi    |
| Protocol     | Brutukul             | Mithaq               | Brutukul             |

## 5.2 Resistance to Neologisms

There is often a psychological barrier among users who prefer familiar English or French terms over newly minted Arabic ones. This is particularly prevalent in medicine and high-end engineering, where the original language of instruction is often non-Arabic.

## 6. Academic Registers and Linguistic Stylistics

Scientific vocabulary development isn't just about individual words; it's about **register**. Academic Arabic must maintain a level of formality (*Fusha*) while being precise enough for technical manuals. The development of scientific Arabic has led to a "Middle Arabic" used in journalism and science that is less ornate than classical literature but more sophisticated than daily speech.

### 6.1 Syntactic Adjustments

The influx of scientific thought has also influenced Arabic syntax. We see an increased use of the passive voice (to mimic objective scientific observation) and a shift toward more complex sentence structures that allow for nuanced technical explanations. The research by Ali indicates that while the morphology remains traditional, the **stylistics** of scientific Arabic are becoming increasingly globalized.

## 7. Future Implications: AI and Machine Translation

In the contemporary era, the development of scientific vocabulary has shifted from the hands of philologists to the algorithms of Artificial Intelligence. Natural Language Processing (NLP) models for Arabic must now handle the massive influx of technical data. The "Linguistic Study of the Development of Scientific Vocabulary" remains relevant today as it provides the ruleset for these AI models.

Modern Large Language Models (LLMs) rely on the morphological patterns identified in 20th-century studies to predict and generate new technical terms. If a new technology emerges tomorrow, the AI uses the principles of **Qiyas** (analogy) to suggest terms that fit the Arabic linguistic structure, effectively automating the role once held by the Language Academies.

## 8. Conclusion: The Resilient Lexicon

The journey of the Arabic language from a vehicle of desert poetry to a medium for quantum physics and aerospace engineering is a testament to its inherent structural flexibility. Through the systematic application of derivation, analogy, and controlled borrowing, Arabic has proven that it is not a "frozen" language of the past, but a living, breathing system capable of scaling with human knowledge.

As documented in the works of Abdul Sahib Mehdi Ali and the wider *Library of Arabic Linguistics*, the key to the language's future lies in its past. By leveraging the ancient root-and-pattern system, Arabic can continue to Arabize the most advanced scientific concepts without losing its unique cultural and linguistic identity. The ongoing

refinement of scientific vocabulary is not merely a technical necessity; it is a vital part of the Arab world's participation in the global scientific community. For students, linguists, and technical writers, understanding these mechanisms is essential for navigating the complex intersection of language and modern progress.

## Baca Juga (Artikel Terkait)

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- [The Evolution of Functional Linguistics: A Technical Analysis of A Communicative Grammar of English by Geoffrey Leech](#)

URL: <http://adriftfloatspa.com/technical-analysis-communicative-grammar-english-geoffrey-leech.pdf>

- [The Linguistic Architecture of Collective Nouns: A Technical and Historical Analysis](#)

URL: <http://adriftfloatspa.com/linguistic-architecture-collective-nouns-technical-analysis.pdf>

- [The Comprehensive Lexicography Manual: Mastering Synonyms, Antonyms, and Semantic Architecture](#)

URL: <http://adriftfloatspa.com/lexicography-manual-synonyms-antonyms-semantic-architecture.pdf>

- [A Technical Masterclass: Analyzing A Grammar of Contemporary English by Quirk, Greenbaum, Leech, and Svartvik](#)

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