The PEGITOSCA Criterion

Precision (P), economy (E), generativity (G), internationality (I), transparency (T), (antiobscenity) (O), systemicity (S), consistency (C) and language - relative acceptability (A) of terms can be acronymically captured as PEGITOSCA. Let it be contended with due circumspect that any theory of scientific terminology and any method or set of methods of terminological elaboration that may ensue from the theory mainly hinge upon the fulfilment of the overall PEGITOSCA criterion for scientific terminology. This is the yardstick of which terminological elaborators of Hebrew, Indonesian, Icelandic, Arabic Amharic, Hindi, Somali, Kinyarwanda or Kiswahili are to varying degrees cognizant. I formulated the criterion for the first time in Kiingi (1989) when I was working on the terminological modernisation of Luganda. I would like to consider three main sources of data for its revised formulation here. The primary source of data are the disciplines of logic, mathematics, physics, chemistry and biology. Then I make contact with some of the leading terminologists of this century: Wester (1979), Werner (1972), Flood (1961), Cahn and Dermer (1959, 1979), Jeffrey (1968), Savory (1970) and Picht and Draskau (1985). The third source entails keen monitoring of the work done at *Taasisi ya Uchunguzi wa Kiswahili* (TUKI); the work assumes its definitive shape in TUKI (1990).

It is common knowledge that whenever we define a term, we aim at its conceptual precision. For the purpose of this inquiry I define the term 'term' as the union of a concept and the sign (or expression) which represents the concept. For instance, in (15) we have three terms but only one concept of mechanics, namely acceleration.

15) acceleration (E.)
Beschleunigung (Ger.)
mchapuko (Ksw.)

All the scientific terminologists regard conceptual precision as the most important criterion for the term status of a linguistic sign. The economy of a term in terms of subjective length of the expression is language-relative. The term in (16) is bearably long in German.

16) *Acetessigs ureethylesterdinitrophenylhydrazon.* We gain easy access to the term by dissecting it into *acet-, essig, "yeast", sure, "acid", ethyl, ester, di-, nitro-, phenyl, hydrazon*. It should be borne in mind, however, that even chemical English has very often to tolerate long expressions. Consider, for example, the substance we call DDT in colloquial parlance.

17) dichlorodiphenyltrichloroethane
$(C_6H_4Cl)_2$:CH . CCl_3

The use of "DDT" is a clear attempt at economy. Productivity (or generativity) is defined as the potentiality of forming expressionas on the basis of relatively few morphemes in a language. The German expressions in (18) exhibit both generativity and systemicity.

18) Telefon Fernsprecher "telephone"
telefonieren fernsprechen "to telephone"
Telefonat Ferngesprch "telephone conversation"
Telefonist "telephone operator"
telefonisch "by telephone"
Telefonie "telephony",
where tele- fern- "far".

By recasting (15) as (19)

19) d^2 **r** $/dt^2$= **a**

we invoke the subcriterion of internationality. It is important to differentiate between Eurocentric and global internationality. Statement (19) conforms to a global convention among mathematical physicists, for the symbolic usage is independent of the natural language of a given physicist. Eurocentric internationality is not necessarily identical to global internationality as (20) clearly reveals.

20) hydrogen H
Wasserstoff H (Ger.)
Oxygen O
Sauerstoff O (Ger.)
Lead Pb
Blei Pb (Ger.)

The names for the three chemical elements in (20) are not globally international, although their symbols are. The German terms Wasserstoff "water stuff" and Sauerstoff "acidic stuff " are far more transparent in German LGP than hydrogen and oxygen. Failure to distinguish Eurocentric from global internationality has led to unnecessary compromising of transparency of modernised Indonesian. Alisjahbana, probably the undisputed architect of scientific Indonesian, reports and opines:

> *Modern European languages are already to a very high degree a unity, since the essential scientific economic, technological and to a certain extent also to the other modern terms expressing the same modern concepts, in most cases use words based on the same Greco-Latin words. In the development of the new modern languages of Asia and Africa, thus also of the Indonesian and Malaysian language which followed a parallel course of vigorous anti-Western nationalism, there was and is a tendency to avoid international words. In the coining of the Indonesian modern terms during the Japanese occupation in Indonesia, for example, the preference in the determination of Indonesian modern terms was as follows:*
>
> *First to look for an existing Indonesian word; if there was no adequate Indonesian word for that concept a search should be made in the various local*

languages. If there was also no fitting word in local languages either, an attempt would be made to find an Asian word. The internationally used terms came last. Fortunately in the deliberations at that time this rule was never applied literally. But on the whole there were three tendencies discernible: a preference for Sanskrit words from the side of the Javanese whose culture has been deeply influenced by India, for Arabic words from the Muslim side and for international words mostly based on Greco-Latin from the modernised younger groups.

On the assumption that science, technology and economics are based on universal concepts and that the world has become more and more a unity because of the modern system of transportation and communication, the most logical and efficient decision in the determination of modern terms should, of course, be the choice of international words, mostly based on Greco-Latin. In the context of the controversy of East and West during the last [sic] century, however, this decision is not a pleasant one for many Asians and Africans. But viewed from a long range, closer co-operation in the modern world for scientific, economic and technological progress and other common interests, it is the best decision. There is very little that Sanskrit and the Arabic language can contribute to twentieth century scientific, technological terminology.

Alisjahbana (1976: 28)

If Alisjahbana takes the view that transparent Indonesian terms should be jettisoned or not coined on a large scale, then he has to reckon with a situation in which scientific Indonesian will be as unintelligible to "ordinary" Indonesian speakers as scientific English is to "ordinary" English speakers. An optimised solution to his problem could be to emulate Germans by ensuring a two-track lexicon consisting of native and foreign words (Fremdw¯rter) as the list in (21) shows.

21)

native German	"foreign" German	English
berschallgeschwindig-keit		"supersonic speed"
Fachausdruck	Terminus	"term"
Strahlung		"radiation"
Umstand		"circumstance"
Schwingung	Vibration	"vibration"
Zerfallsgesetz		"law of decay"
Zerlegung	Analyse	"analysis"
Zustandsgleichung		"equation of state"
Widerspruch		"contradiction"
Gegenbeispiel		"counterexample"
Bedeutungslehre	Semantik	"semantics"
Lautlehre	Phonetik	"phonetics"

erzeugen	generieren	"generate"
Briefwechsel	Korrespondenz	"correspondence"
bermensch		"superman"
erdkundlich	geographisch	"geographical"
Volkswirtschaftslehre	National¯konomie	"national economics"
V¯lkerkunde	Ethnologie	"ethnology"
Fernrohr	Teleskop	"telescope"
Feuchtigkeit		"humidity"
Fliehkraft	Zentrifugalkraft	"centrifugal force"
Gleichung		"equation"
Grenzwert	Limes	"limit[ing]value"
Halbleiter		"semiconductor"
Wissenschaftler		"scientist"
Sonnenfinsternis		"solar eclipse"
Halbkugel	Hemisphere	"hemisphere"
Halbinsel		"peninsula"
Fernsehen		"television"
Frauenheilkunde	Gynäkologie	"gynaecology"
Luftfahrt		"aviation"
Mengenlehre		"set theory"
Himmelsk¯rper		"celestial body"
Salzbildner	Halogen	"halogen"
Lehrsatz	Theorem	"theorem"
Kreftevieleck		"force polygon"
Strom		"current"
Kernspaltung		"nuclear fission"
Schwere	Gravitation	"gravitation"
Kernladungszahl		"atomic number"
Reibungszahl		"coefficient of friction"
Beiwert	Koeffizient	"coefficient"
Brechungsgesetz		"law of refraction"
Widerstand		"resistance"
Ableitung		"derivation"
Drall		"rotational impulse"
Gattung	Genus	"genus"
Art	Spezies	"species"
Druck		"pressure"
Durchmesser		"diameter"
Beziehung	Relation	"relation"
gerichtlich	forensisch	"forensic"
Abstammungslehre	Evolutionstheorie	"theory of evolution"
urs‹chlich	kausal	"causal"
Bücherei	Bibliothek	"library"
Stamm		"phylum"
Volksherrschaft	Demokratie	"democracy"

Werkzeug	Instrument	"instrument"
Scheinwissenschaft		
Pseudowissenschaft		"pseudoscience"
Gelenkentzuendung	Arthritis	"arthritis"
Ursprache		"proto-language"
Sprachwissenschaft	Linguistik	"linguistics"
Entsalzungsanlage		"desalination plant"
W¯rterbuch		"dictionary"
Sure		"acid"
Blutarmut	Anemie	"anaemia"
Kohlenstoff		'carbon'
Stickstoff		'nitrogen'
Rundfunk	Radio	'radio'
bestm¯glich	Optimal	'optimal'
Forderung	Axiom	'axiom'
Volksversammlung	Parlament	'parliament'
Ausschuss	Komitee	'committee'
Rechnung	Kalk·l	'calculus'
H‹ufigkeit	Frequenz	'frequency'
Reihe	Serie	'series'
Vergleichend	Komparativ	'comparative'
Teilchen	Partikel	'particle'
verneinung	Negation	'negation'
Vorbild	Modell	'model'
Sprachlehre	Grammatik	'grammar'
Winkel		'angle'
Wertigkeit	Valenz	'valency'
gleichwertig	equivalent	'equivalent'
Widerspruchsfreiheit	Konsistenz	'consistency'
Grundsatz	Prinzip	'principle'
Aussage	Proposition	'proposition'
Voraussetzung	Premisse	'premise'
Geschwindigkeitsmesser	Tachometer	'speedometer'
Waagerecht	Horizontal	'horizontal'
senkkrecht	Vertikal	'vertical'
Bewegungsgr[illegible]e		'momentum'
Erkenntnislehre	Epistemologie	'epistemology'
Wiedergeburt	Renaissance	'renaissance'
Erscheinung	Phenomen	'phenomenon'
Versuch	Experiment	'experiment'
Sternwarte	Observatorium	'observatory'
Wetterkunde	Meteorologie	'meteorology'
Krankheitszeichen	Symptom	'symptom'
Maschinenbau		'mechanical engineering'
Erdneuzeit	Kenozoikum	'Cenozoic (Era)'

Erdmittelalter	Mesozoikum	'Mesozoic (Era)'
Erdaltertum	Paleozoikum	'Paleozoic (Era)'

What should be clearly noted here is that although German uses and is compelled to use Eurocentric terms like *Atom, Mathematik, Geometrie, Topologie, Literatur, Physik, Nitrat, Karbonat and Elektron,* there is a conspicuous predilection for terms based on its native lexical stock. If the concept *Unsch‹rfebeziehung* created by the German-speaking physicist Schr¯dinger was to be rendered later into English as the *uncertainty relation* (we take note of the Latin roots), the English term did not attain more precision and global internationality. It did, however, achieve Eurocentric internationality.

Picht and Draskau (1985: 116-7) offer a catalogue of criteria for terminology by recommending that an ideal term

(a) must be well-motivated [T]
(b) should be systematic [S]
(c) must accord with the syntactic rules of the language [A]
(d) must be potentially productive [G]
(e) must avoid pleonasm [E]
(f) should not contain superfluous elements [E]
(g) should be as short as possible without adversely affecting its clarity [E]
(h) should preferably not have synonymous, homonymous nor polysemous terms [P]
(i) should preferably not present orthographical or morphological variations. [C]

They conclude their catalogue of criteria by asserting:

> *Every one of these rules and norms is founded upon observation and investigation. Their practical value is not under discussion, however, it should be remembered that they are not all applicable at once or in all possible combinations. In creating, analysing or evaluating a term, these recommendations should be borne in mind, and a pragmatic and realistic decision reached, which take account of:*
>
> *- sociolinguistic factors which determine a possible rebuff for the user; [A]*
> *- consideration of the difficulties and advantages connected with the revision of a terminology which,*
> *though defective, is well-established; [A]*
> *- the degree of "internationalness" [I]*
>
> Picht & Draskau [ibid.]

They insist on the word order in the language exemplified by them according to (22); and criticise inconsistency according to

22) Dieselmotor Ger.
moteur Diesel F.
diesel engine E.

23) labour labor
centre center
theatre theater

In the course of monitoring problems of the terminological modernisation of Kiswahili , I realise that the subcriterion of acceptability should be analysed into nine infracriteria: purpose, receptor-friendliness, ecology, social system, cutural system, language, antecedence, style and speech-act. Let me show how we gain access to these infracriteria by posing relevant questions in the order of presentation.

(a) What is the purpose of introducing the terminology?
(b) Is the terminology suitable for the receptor group being targeted?
(c) Are we discoursing on animals, plants and land features familiar to the receptors?
(d) Can we relate our terminology to the social system of the receptors?
(e) Do we take the cultural system of the receptors into account?
(f) Do we take the phonological, morphological and syntactical structure of the receptor language as sacrosanct?
(g) Is a trend in expression formation or assimilation already manifest in the receptor language?
(h) Is the style of the texts in which the terminology is to feature formal, informal polite or familiar?
(i) Is a given term appropriate in the execution of illocutionary and perlocutionary acts?

I surmise that my presentation of the PEGITOSCA Criterion could erroneously be construed as a proposed theory of scientific terminology. It is rather a mere but pivotal component of my theory of scientific terminology that I advance in Chapter II.

My theory is formalised on the basis of axioms, basic and defined concepts. The PEGITOSCA Criterion relates the calculus of the formalised theory to the real world of terms. It is therefore, what a philosopher of science calls a bridging rule. The Criterion, by itself, does not lead the terminologist to an expression. It is, rather, a yardstick for the terminologicality of the expression previously generated or found. I now submit that an expression for term status in whatever language fulfills the criterion such that

t =f (P, E, G, I, T, O, S, C) + y (A),

Where f and y are functions, is maximised as the degree of terminologicality t. For the subcriterion A, I coin another well-motivated acronym so that

t =f (P, E,..., S, C) + y (p, r, e, s, c, l, a, s,* a*),

I now assign discrete values to the terminological factors as Follows:

P = p = r = l= ! 3

E = G = I =S = C = a = ! 2
T = O = e = s = c = s* = a * = ! 1

I stipulate that in logic, mathematics, physics, chemistry, biology and medical science the subcriteria precision, economy and generativity be obligatory. Internationality and systematicity should be additionally mandatory in physics, chemistry, biology and medical science.

I conclude this Section with a review of the *Kamusi Sanifu ya Biolojia, Fizikia na Kemia* published in TUKI (1990). The *Kamusi* is an alphabetically arranged unidirectional (English-Kiswahili) dictionary encompassing about 4,000 entries. It will be reviewed by reconstructing the structure of an entry article and the style manual for its compilers. Subsequently, the PEGITOSCA criterion will be applied to a cross-section of entries with a view of determining serious violations of the criteria for scientific terminology.

Should it emerge from the discussion that the target group for the *Kamusi* is not ascertainable, and that the G, T ,O ,C, and A were grossly violated while the too frequent kiswahilisation of English terms apparently accommodates the criteria P, E, I and S, then the inescapable conclusion will be that the *Kamusi* is in need of a radical overhaul.

In order to reconstruct the style manual used in the compilation and writing of the *Kamusi*, we first profitably exhibit two typical entries and then traverse the *Kamusi* searching additional elements of the style manual.

1. Pesticide n kiuavisumbufu (vi-): kitu kinochoua visumbufu, aghalabu dawa. Viuavisumbufuvu vyaweza kuwa viuawadudu, viuamagugu viuakarina,viuakonokono, viuapanya, viuandege, viuakuvu, viuaminyoo, n.k. [Kem]
2. Planck's constant (h) n kibaki planki (h): namba ya uwiano kati ya uwiano kati ya fotoni na marudio ya nuru. Ina thamani ya 6.63 x 10-34 Js [Fiz].

It clearly emerges that a typical entry article manifests the general components:

(a) the English entry term.
(b) a symbol or abbreviation e.g. h (Planck's Constant)
(c) The lexical category of (a) e.g. n (noun)
(d) The Kiswahili equivalent
(e) the plural form of (d) e.g. vi-in (1)
(f) a definition of (d) in Kiswahili
(g) a field label [Bio] for Biology
[Kem] for Chemistry
[Fiz] for Physics.

It may well be conceded that the above-reconstructed general structure of an entry article is adequate for users who are already competent in mainstream English and Kiswahili such that, for instance, issues of pronunciation and etymology are rendered redundant.

Nevertheless, there are lexicographical inadequacies, three of which should be specifically recorded.

First, abbreviations like ATP, DNA, TNT (see pp.3 and 167) are introduced in their pertinent articles but do not themselves feature as entries. Note, however, that RNA, EMF, EMU, STP, ESU and NTP are not only introduced under their relevant entries but they, in turn, are also entries. Secondly, although affixes and affixoids like *kilo-, giga-, nano-, milli-, trans-* and *phyto-* are included, it is outright inexplicable to exclude all generative suffixes and suffixoids and to ignore one of the most generative morphemes in physics: *electr (o)-*.

Thirdly, and the most unfortunate of all, apart from lists of abbreviations and symbols on pp. viii and ix [under *Maelezo kwa Mtumiaji* "Using the Dictionary"] and the *Jedwali la Elementi* "A Table of [Chemical] Elements", the following staple series entries in any natural scientific pedagogical dictionary of reasonable format are totally missing:

(a) the periodic table of chemical elements
(b) the Greek alphabet
(c) the SI units and symbols
(d) the biological nomenclature
(e) important constants and standards (with their symbols and values in SI units)
(f) the chemical nomenclature
(g) the solar system.

I anticipate and appreciate the endeavour on the part of the *Kamusi* compilers to economise dictionary space and thus keep production costs to a minimum. That state-of-affairs notwithstanding, it is hardly pretentious to pose the question: for whom was the *Kamusi* prepared? Concomitant with this question is the question whether the PEGITOSCA criterion for terminology has been fulfilled.

The work of a terminologist, consists in optimising the two functions Ψ and Φ while bearing in mind how a certain given subscriterion may militate against another subcriterion or infracriterion. This should become clear as we proceed gauging selected Kiswahili terms from the *Kamusi* against the PEGITOSCA Criterion.

In (24), conceptual precision of a term remains elusive.

24) "astronomy" *unajimu*
unajimu cannot be "astronomy"and "astronomy" simultaneously.

The zeal for expressional economy may lead to a questionable Kiswahili rendition as (25) shows:

25) "sodium chloride" *natiri kloridi*
French "chlorure de sodium"
German "Natriumchlorid"

We surmise that some of the more careful speakers of Kiswahili would prefer *kloridi ya natiri* to (25).

Generativity, as prompted by the English in (26), is a welcome move towards the extrapolation of the lexical morphology of Kiswahili.

26) "magnet" sumaku
"magnetism" usumaku
"magnetise" sumakisha

Compliance with internationality of terminology does not merely entail kiswahilisation of the English terms derived from Greco - Latin but, rather, the adoption of internationally stipulated symbols as in

27) "xenon" *zenoni*Xe

The term equivalent to "xenon" may even be entirely native; but the symbol for the chemical element xenon is the internationally binding "Xe".

The *Kamusi* compilers are inconsistent in their attempt to meet the subcriterion of transparency. I cannot discern any terminological reason why in (28) presumably with the exception of (28a) expressional transparency is incomplete.

28a) "quantised" *iliyokwantishwa*
28b) "univalent" *-a valensimoja*
"pentavalent" *pentavalenti*
28c) "phytophagy" *ulajimimea*
"saprophyte" *saprofiti*
28d) "photolysis" *uvunjikajikimwanga*
"hydrolysis" *majimvunjo*
"dialysis" *dialisisi*
"electrolysis *elecktrolisisi*
"pyrolysis" *pirolisisi*
"glycolysis" *glikolisisi*
"plasmolysis" *plazimolisisi*
"thermometry" *upimaji halijoto*
"pyrometry" *pirometri*
"calorimetry" *upimaji joto*
28e) "hydrophyte" *kimeamajini*
"halophyte" *mmeachumvi*
"xerophytes" *zerofita*
"xerophytic" *-a zeromofi (sic)*
28f) "sulphuric" *sulfuriki*
"sulphurous" *sulfurasi*
28g) "petrology" *petrolojia*
"zoology" *zuolojia*

"optics" *elimunuru*

28h) "inert" *ajizi*
"inertia" *ineshi*

28i) "venom" *sumu*
"toxicology" *toksikolojia*

28j) "kingdom" *ufalme*
"phylum" *kabila*
"class" *?*
"order" *oda*
"family" *familia*
"genus" *jenasi*
"species" *spishi*

It is highly doubtful if taboo words as in (29) can ever be accepted as Kiswahili terms.

29) "penis" *mboo*
"vagina" *kuma*
"anus" *mkundu*

Apart from the vacillation in terms of transparency we saw in (28), there is vacillation in terms of the source language from which expressions are to be kiswahilised (if that is the only option available). Consider the kiswahilisation of Greek and anglicised Greek in (30)

30) "dyne" *daini*
"cytology" *sitolojia*
"psychrometry" *usaikrometri*
"microbiology" *mikrobiolojia*
"micrometre " *mikrometa*

From our foregoing analysis, we can now draw conclusions as to how the functions ⊕ and Ψ in the PEGITOSCA Criterion have been handled by the *Kamusi* compilers.

Excessive kiswahilisation of English terms has ensured precision, economy, generativity and systemicity. At the same time, the uncontrolled prospensity towards kiswahilisation has made it difficult to ensure transparency and also to ground the terminology (at least biological nomenclature) in the general socio-cultural system of Kiswahili users. The adoption of taboo words militates against style, which is inherent in the speech-act infra-criterion.