

Modelling indigenous counting systems for base-10 and related applications: Abureni numerals as case study

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Abstract

Indigenous counting systems and numbering have unique attributes that are linked to the cultures of their speech communities. Indigenous people have used various methods of counting and numbering things based on the meaning they intend to communicate, in terms of their value and significance. A counting system starts from small simple single-word numbers and grows to large complex numbers that may be descriptive in nature. As the numbers increase, they become more difficult to count, requiring the use of certain key numerals as pivots to produce their multiples in a cyclical pattern. However, these pivotal numerals upon which a particular counting system is based vary from one tradition to another. The introduction of base-10, the concept of 'zero' as a number, and the use of binary logic in digital technology have become universal standard methods of addressing such ethno-cultural variations. They are significant in the discourse of language and globalization, especially in the computation and business environment of today. This paper seeks to contribute to the discussion on the need to model the features of indigenous counting systems such that they benefit from the inherent gains of base-10 and related applications of the modern day. It adopts a semantic-pragmatic approach to describe and analyse indigenous numbering patterns against those of base-10, using the Abureni numerals as the data for the study. The objective is to show the points of synergy that the numerals could be modeled for base-10 applications in a manner that they sound natural in the indigenous language, in terms of context and meaning. The paper concludes that the features of an indigenous counting system can be patterned to produce a base-10 model of it, without disrupting the traditional numbering pattern of the target language.

Key Words: Indigenous counting system, numbering, modelling, base-10, Abureni numerals.

1. Introduction

The Abureni language is spoken in the southern border communities of Bayelsa and Rivers States of Nigeria. It is classified under Niger-Congo, Atlantic-Congo, Volta-Congo, Benue-Congo, Cross River, Delta Cross, Central Delta (Williamson, 1989, p. 261).

According to Chan (2020), Abureni has a vigesimal numeral system like that of the Ogbia language, suggesting it exhibits certain characteristics of base-20. Etire (2015) notes that in mathematical and computing terms, the Abureni numeral system should be described as having the primary features of base-4 numeral system but using the 1st and 2nd indices of 10 as multipliers.

The word ‘base’ has been defined in terms of the use of numbers built on a numeration scale by the *Oxford Lexicon* (2021). For Weisstein (2021), ‘base’ in mathematics is used to refer to a particular mathematical object that is used as a building block.’ He further observes that it is the number system that defines logarithms. Specifically, the base-10 and base-4 notational systems feature in the discourse with some of the numbers expressed in scientific notations as defined below:

Base10: Decimal is the base-10 notational system for representing real numbers (Weisstein, 2021).

Base-4 or quaternary: of, relating to, or being a number system with a base of four (Merriam-Webster Dictionary, 2021).

Standard form or scientific notation of a number: a notation that consists of the product of the number with the power of 10s (EasyCalculations, 2021).

Forty: a number equal to four times 10 (Merriam-Webster, 2021); the cardinal number equal to 4×10 (American Heritage Dictionary, 2011).

In the Abureni traditional numeral system, the pivotal numerals ‘40’ and ‘400’ are used to produce higher numbers in a cyclical pattern. The process becomes more difficult as the numbers increase compared to base-10 or decimal systems, where large figures are easier to calculate as multiples of the numeral 10. This calls for the need to produce a base-10 model of the indigenous counting system to keep pace with modern computation techniques brought about by globalization. For such an option to be acceptable to the people, it is necessary to fashion it in a manner that the numerals sound natural in their indigenous language, in terms of context and meaning, without fear of losing the traditional counting system.

Counting of numbers is done progressively, and as the values increase in traditional counting methods such as the vigesimal system, it becomes more complicated to count. Certain key numbers are used as pivots to derive their multiples in attempt to calculate large numerical values, doing so in a recurring pattern. However, these pivotal numbers upon which a particular counting system is based varies from one tradition to another (Ikoko-Okparan et al, 2007). Some scholars see the issue as opportunity for people to consider alternative counting systems and make their choices that would meet their needs. According to Beardon (2010), people are accustomed to writing numbers in base ten, but numbers can be written in any number base and vice versa. For example, Awoyale (2020) in Urua et al (2020) notes that the Yoruba Language has efficiently sustained both traditional and decimal systems, corroborating Beardon's view. On the issue of functional relevance of the decimal system, Awoyale (2020) further observes that it represents the future of the technological age. Dada et al (2015) in Ugorji and Yuka (2015), note that when two languages come in contact in such a manner, maintenance of the indigenous language becomes necessary to avoid a total shift to the one with greater influence.

We acknowledge the ongoing work on cardinal numeral systems and traditional numerals with tones, under the Counting Concepts and Numeral Systems Project with focus on African Languages in Chan (2020). It captures traditional numerals with tones such as the features of Abureni numerals (Etire 2020). Some scholars have produced variations of base-10 counting system in their enumeration such as Madighi (2019) on Abuan, a neighbouring language to Abureni in same classification.

A semantic-pragmatic approach is used to describe and analyse the indigenous numbering patterns against those of base-10, built on Grice's theory of conversation and meaning. Herbert Paul Grice (1913-1988) was an eminent British philosopher and linguist who propounded the theory in 1948 and first published in 1957. According to Grandy (1989), the writings on meaning had since been published at intervals over a 30-year period with variants and objections and commentaries. He proposed four conversational maxims that arise from the pragmatics of natural language (Benton, 2020). These maxims, also called Gricean maxims, are quantity (the need to be informative as much as possible), quality (the need to be truthful), relation (the need to be relevant), and manner (the need to be clear). Some scholars acknowledge the maxims as useful tools to explain the meaning of what a speaker intends to communicate such that the recipient understands without ambiguity. For example, Betti (2021) notes that the Gricean maxims are 'a way to explain the link between utterances and what is understood from them.' Similarly, Shatz (2019) views them as 'a set of observations that describe how people communicate when they want to be properly understood,' and that they can be used as guiding principles.

The reason for this choice is the need to make meaning out of the model that is being introduced as an alternative to the traditional counting system. The thrust is to present the data in a way that the features of base-10 model sound natural and acceptable to the people. According to Wilson and Sperber (1981), the key benefit of Grice's approach is 'the illustration of facts and constraints in texts, thus showing the semantic consequences for communication quality.' Similarly, in a discourse on the use of language to communicate, Morris (2006) observes that what is meant in one language is always open to being captured in another language and that making meaning central enhances understanding. This gives credence to the maxim of quality, where one tries to be truthful by providing information that is supported by evidence instead of something that is false. With such an approach, the native speakers would be in a better position to accept the new system and its applications without fear of losing their traditional counting system.

The scope of this study covers the traditional counting system in Abureni, including aspects of the modern international counting system of base-10, stated in Abureni terminology. It states how the Abureni numerals are built around the base four (4) and the base ten (10) number bases described in Beardon (2000). The role played by certain key and recurring numerals in the counting process is stated to ensure understanding of the basics. The four numerals: 'four (4)', 'twenty (20)', 'forty (40)' and 'four hundred (400)' fall in this category.

2. The data

The data is a collection of numerals selected from the Abureni counting system and the decimal system. They include the pivotal and recurring numerals which are critical in the analysis of the traditional counting method.

The first ten numerals: 10 samples

- | | |
|----------------|-------------------------|
| 1. ònî /ònî/ | 6. òdî /òdî/ |
| 2. ìwàl /ìwàl/ | 7. òdùèl /òdùèl/ |
| 3. ìsàr /ìsàr/ | 8. òbhabhanya /òbàbàrà/ |
| 4. ìnyà /ìnyà/ | 9. esughò [ésùgò] |
| 5. òghò /òghò/ | 10. òdìòb /òdìòb/ |

Numeral 10 (ten) and its powers: 10 samples.

10. òdìòb /òdìòb/

100. *iwál ɛwala ná ɔ́dusubh /iwál èwálá nè èdùsúb/*
 1000. *iwál ɔ́nir ná ogho ɛwala /iwál ɔ́nir nè òyò èwálá/*
 10,000. *ɔ́dusubh ná ogho ɔ́nir /èdùsúb nè òyò ɔ́nir/*
 100,000. *odin ɛwala ná diobh ɔ́nir /òdìn èwálá nè d̩iòβ ɔ́nir/*
 1,000,000. *odin ɔ́nir ná iwál ɛwala ná ɔ́dusubh ɔ́nir /òdìn ɔ́nir nè iwál èwálá nè èdùsúb ɔ́nir/*
 10,000,000. *erabharabh ná iwál ɔ́nir ná ogho ɛwala ɔ́nir /èràβàràβ nè iwál ɔ́nir nè òyò èwálá ɔ́nir/*
 100,000,000. *ɔ́nir ná ogho ɛwala ná ɔ́dusubh ná ogho ɔ́nir ɔ́nir /ɔ́nir nè òyò èwálá nè èdùsúb nè òyò ɔ́nir ɔ́nir/*
 1,000,000,000. *diobh ná ogho ɔ́nir ná odin ɛwala ná diobh ɔ́nir /d̩iòβ nè òyò ɔ́nir nè òdìn èwálá nè d̩iòβ ɔ́nir ɔ́nir/*
 10,000,000,000. *isár ɛwala ná ɔ́dusubh diobh ná odin ɔ́nir ná iwál ɛwala ná ɔ́dusubh ɔ́nir ɔ́nir /isár èwálá nè èdùsúb d̩iòβ nè òdìn ɔ́nir ná iwál èwálá nè èdùsúb ɔ́nir ɔ́nir/*

Numeral 40 (forty) as a pivot and its cyclical counts: 10 samples.

40. *erubál /èrúbèl/*
 80. *iwál ɛwala /iwál èwálá/*
 120. *isár ɛwala /isár èwálá/*
 160. *inya ɛwala /inè èwálá/*
 200. *ogho ɛwala /òyò èwálá/*
 240. *odin ɛwala /òdìn èwálá/*
 280. *odual ɛwala /òdùèl èwálá/*
 320. *obhabhanya ɛwala /òβàβàpà èwálá/*
 360. *esugho ɛwala /ésùyó èwálá/*
 400. *ɔ́nir /ɔ́nir/ (diobh ɛwala /d̩iòβ èwálá/)*

Numeral 400 (four hundred) as a pivot and its powers: 4 samples.

400. *ɔ́nir /ɔ́nir/*
 160,000. *ɔ́nir ɔ́nir ɔ́nir /ɔ́nir ɔ́nir ɔ́nir/*
 64,000,000. *ɔ́nir ɔ́nir ɔ́nir ɔ́nir /ɔ́nir ɔ́nir ɔ́nir ɔ́nir/*
 25,600,000,000. *ɔ́nir ɔ́nir ɔ́nir ɔ́nir ɔ́nir /ɔ́nir ɔ́nir ɔ́nir ɔ́nir ɔ́nir/*

Selected numerals between 400 and 1,000: 6 samples

444. ònîr nà èrúbàl nà ìnyà /ònîr nè èrúbèl nè ìjè/
 503. ònîr nà ìwàl èwálá nà àdùsùbh nà ìsàr /ònîr nè ìwàl èwálá nè ìsàr/
 660. ònîr nà òdìn èwálá nà àdùsùbh /ònîr nè òdìn èwálá nè èdùsùb/
 729. ònîr nà òbhàbhànyâ èwálá nà ésùghó /ònîr nè òbàbàjà èwálá nè ésùyó/
 875. ìwàl ònîr nà èràbhàràbh nù dīòbh nà òghò /ìwàl ònîr nè èràbàràb nù dīòb nè òyò/
 972. ìwàl ònîr nà ìnyà èwálá nà dīòbh nà ìwàl /ìwàl ònîr nè ìjè èwálá nè dīòb nè ìwàl/

Selected numerals between 1,000 and 1,000,000: 4 samples

1438. ìsàr ònîr nà òghò èwálá nà àdùsùbh dīòbh nà òbhàbhànyâ /ìsàr ònîr nè òyò èwálá nè èdùsùb dīòb nè òbàbàjà/
 10,041 àdùsùbh nà òghò ònîr nà èrúbàl nà ònîn /àdùsùb nè òyò ònîr nè èrúbèl nè ònîn/
 16,064. èrúbàl ònîr nà èràbhàràbh nà ìnyà /èrúbèl ònîr nè èràbàràb nè ìjè/
 158,280. ésùghó èwálá nà àdùsùbh dīòbh nà òghò ònîr nà òdùàl èwálá /ésùyó èwálá nè èdùsùb dīòb nè òyò ònîr nè òdùàl èwálá/

Sample numerals in base-10 expressed in Abureni terms

10 (ten) as a pivotal numeral and counting in tens: 10 samples.

- | | |
|----------------------------|-------------------------------------|
| 10. dīobh /dīòb/ | 60. odin dīobh /òdìn dīòb/ |
| 20. ìwal dīobh /ìwàl dīòb/ | 70. oduàl dīobh /òdùàl dīòb/ |
| 30. ìsar dīobh /ìsàr dīòb/ | 80. òbhabhanya dīobh /òbàbàjà dīòb/ |
| 40. ìnyà dīobh /ìjè dīòb/ | 90. esugho dīobh /ésùyó dīòb/ |
| 50. ogho dīobh /òyò dīòb/ | 100. dīobh dīobh /dīòb dīòb/ |

100 (one hundred) as a pivotal numeral and counting in hundreds: 10 samples.

- | | |
|-----------------------|-----------------------------|
| 100. dīobh dīobh | 600. odin dīobh dīobh |
| 200. ìwal dīobh dīobh | 700. oduàl dīobh dīobh |
| 300. ìsar dīobh dīobh | 800. òbhabhanya dīobh dīobh |
| 400. ìnyà dīobh dīobh | 900. esugho dīobh dīobh |
| 500. ogho dīobh dīobh | 1,000. dīobh dīobh dīobh |

1,000 (one thousand) as a pivotal numeral and counting in thousands: 10 samples.

- 1,000. dīobh dīobh dīobh /dīòb dīòb dīòb/
 2,000. ìwal dīobh dīobh dīobh /ìwàl dīòb dīòb dīòb/
 3,000. ìsar dīobh dīobh dīobh /ìsàr dīòb dīòb dīòb/

- 4,000. **inya** diobh diobh diobh /ɪnə̀ diòβ diòβ diòβ/
- 5,000. **ogho** diobh diobh diobh /òyò diòβ diòβ diòβ/
- 6,000. **odin** diobh diobh diobh /òdìn diòβ diòβ diòβ/
- 7,000. **odual** diobh diobh diobh /òdùàl diòβ diòβ diòβ/
- 8,000. **obhabhanya** diobh diobh diobh /òβàβàɲà diòβ diòβ diòβ/
- 9,000. **esugho** diobh diobh diobh /ésùyó diòβ diòβ diòβ/
- 10,000. **diobh** diobh diobh diobh /dìòβ diòβ diòβ diòβ/

1,000,000 (one million) as a pivotal numeral and counting in millions: 10 samples.

- 1,000,000. diobh diobh diobh diobh diobh diobh
- 2,000,000. **iwal** diobh diobh diobh diobh diobh diobh
- 3,000,000. **isar** diobh diobh diobh diobh diobh diobh
- 4,000,000. **inya** diobh diobh diobh diobh diobh diobh
- 5,000,000. **ogho** diobh diobh diobh diobh diobh diobh
- 6,000,000. **odin** diobh diobh diobh diobh diobh diobh
- 7,000,000. **odual** diobh diobh diobh diobh diobh diobh
- 8,000,000. **obhabhanya** diobh diobh diobh diobh diobh diobh
- 9,000,000. **esugho** diobh diobh diobh diobh diobh diobh
- 10,000,000. **diobh** diobh diobh diobh diobh diobh diobh

1,000,000,000 (one billion) as a pivotal numeral and counting in billions: 4 samples.

- 1,000,000,000. diobh diobh diobh diobh diobh diobh diobh diobh diobh
/dìòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ/
- 2,000,000,000. **iwal** diobh diobh diobh diobh diobh diobh diobh diobh diobh
/ìwàl diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ/
- 3,000,000,000. **isar** diobh diobh diobh diobh diobh diobh diobh diobh diobh
/ìsàr diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ/
- 4,000,000,000. **inya** diobh diobh diobh diobh diobh diobh diobh diobh diobh
/ɪnə̀ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ/

1,000,000,000,000 (one trillion) as a pivotal numeral and counting in trillions: 4 samples

- 1,000,000,000,000.
diobh diobh diobh diobh diobh diobh diobh diobh diobh diobh diobh
/dìòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ/
- 3,000,000,000,000.
isar diobh diobh diobh diobh diobh diobh diobh diobh diobh diobh diobh
diobh /ìsàr diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ diòβ/

5,000,000,000,000.

ogho diobh diobh diobh diobh diobh diobh diobh diobh diobh diobh
diobh /òyò dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb/

7,000,000,000,000.

odual diobh diobh diobh diobh diobh diobh diobh diobh diobh diobh
/òdùàì dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb dìòb/

3. Data analysis and findings

In a critique of numeral base systems, Beardon (2010) notes that “in base 10, the columns represent powers of 10 and have ‘place value’ 1, 10, 10², 10³, etc., reading from right to left. Abureni numerals are also read from left to right.

4.1 Counting rules on the traditional system.

The numeral 20 (twenty)

The numeral ‘20’ is mentioned twenty times in the region 20 to 39. The next time it is mentioned is in the region 100 to 119, then it recurs after every 20 counts.

- 20.** àdùsùbh /èdùsùβ / ‘twenty.’
- 21. àdùsùbh nà ònín /èdùsùβ nè ònín/
- 22. àdùsùbh nà ìwàl /èdùsùβ nè ìwàl/
- 23. àdùsùbh nà ìsàr /èdùsùβ nè ìsàr/
- 23. àdùsùbh nà ìnyà /èdùsùβ nè ìnyà/
- 25. àdùsùbh nà òghò /èdùsùβ nè nè òyò/
- 26. àdùsùbh nà òdìn /èdùsùβ nè òdìn/
- 27. àdùsùbh nà òdùàì /èdùsùβ nè òdùàì/
- 28. àdùsùbh nà òbhàbhànyâ /èdùsùβ nè òbàbànyâ/
- 29. àdùsùbh nà èsùghó /èdùsùβ nè èsùyó/

- 30.** àdùsùbh nà dìòbh /èdùsùβ nè dìòb/ ‘twenty and ten’; ‘thirty.’
- 31. àdùsùbh nà dìòbh nà ònín /èdùsùβ nè dìòb nè ònín/
- 32. àdùsùbh nà dìòbh nà ìwàl /èdùsùβ nè dìòb nè ìwàl/
- 33. àdùsùbh nà dìòbh nà ìsàr /èdùsùβ nè dìòb nè ìsàr/
- 34. àdùsùbh nà dìòbh nà ìnyà /èdùsùβ nè dìòb nè ìnyà/
- 35. àdùsùbh nà dìòbh nà òghò /èdùsùβ nè dìòb nè òyò/
- 36. àdùsùbh nà dìòbh nà òdìn /èdùsùβ nè dìòb nè òdìn/

37. àdùsùbh nà dìòbh nà òdùàl /èdùsùβ nè djiòβ nè òdùèl/
 38. àdùsùbh nà dìòbh nà òbhàbhànyâ /èdùsùβ nè djiòβ nè òβàβàṅâ/
 39. àdùsùbh nà dìòbh nà ésùghó /èdùsùβ nè djiòβ nè ésùyó/ ‘twenty and ten and nine’; ‘thirty-nine.’

4.1.1 Counting to 40 (forty) for the first time

Upon counting to forty for the first time, numeral ‘40’ is called *èrúbàl* /èrúbèl/. It is mentioned twenty times in the region 40 to 59. The next time it is mentioned is in the region 440 to 459, then it recurs after every four hundred counts.

40. èrúbàl /èrúbèl/ ‘forty’
 41. èrúbàl nà ònín /èrúbèl nè ònín/
 42. èrúbàl nà ìwàl /èrúbèl nè ìwàl/
 43. èrúbàl nà ìsàr /èrúbèl nè ìsàr/
 44. èrúbàl nà ìnyà /èrúbèl nè ìnyè/
 45. èrúbàl nà òghò /èrúbèl nè òyò/
 46. èrúbàl nà òdìn /èrúbèl nè òdìn/
 47. èrúbàl nà òdùàl /èrúbèl nè òdùèl/
 48. èrúbàl nà òbhàbhànyâ /èrúbèl nè òβàβàṅâ/
 49. èrúbàl nà ésùghó /èrúbèl nè ésùyó/
 50. èrúbàl nà dìòbh /èrúbèl nè djiòβ/ ‘forty and ten’; ‘fifty’
 51. èrúbàl nà dìòbh nà ònín /èrúbèl nè djiòβ nè ònín/
 52. èrúbàl nà dìòbh nà ìwàl /èrúbèl nè djiòβ nè ìwàl/
 53. èrúbàl nà dìòbh nà ìsàr /èrúbèl nè djiòβ nè ìsàr/
 54. èrúbàl nà dìòbh nà ìnyà /èrúbèl nè djiòβ nè ìnyè/
 55. èrúbàl nà dìòbh nà òghò /èrúbèl nè djiòβ nè òyò/
 56. èrúbàl nà dìòbh nà òdìn /èrúbèl nè djiòβ nè òdìn/
 57. èrúbàl nà dìòbh nà òdùàl /èrúbèl nè djiòβ nè òdùèl/
 58. èrúbàl nà dìòbh nà òbhàbhànyâ /èrúbèl nè djiòβ nè òβàβàṅâ/
 59. èrúbàl nà dìòbh nà ésùghó /èrúbèl nè djiòβ nè ésùyó/ ‘forty and ten and nine’; ‘fifty-nine.’

4.1.2 The numeral 60 (sixty)

The numeral ‘60’ is mentioned twenty times in the region 60 to 79. The next time it is mentioned is in the region 460 to 479, then it recurs after every four hundred counts.

60. ẹ̀rábhàràbh /ẹ̀rábàràḅ/ ‘sixty.’
 61. ẹ̀rábhàràbh nà ònín /ẹ̀rábàràḅ nẹ̀ ònín/
 62. ẹ̀rábhàràbh nà ìwàl /ẹ̀rábàràḅ nẹ̀ ìwàl/
 63. ẹ̀rábhàràbh nà ìsàr /ẹ̀rábàràḅ nẹ̀ ìsàr/
 64. ẹ̀rábhàràbh nà ìnyà / ẹ̀rábàràḅ nẹ̀ ìnyà/
 65. ẹ̀rábhàràbh nà òghò / ẹ̀rábàràḅ nẹ̀ òyò/
 66. ẹ̀rábhàràbh nà òdìn /ẹ̀rábàràḅ nẹ̀ òdìn/
 67. ẹ̀rábhàràbh nà òdùàl /ẹ̀rábàràḅ nẹ̀ òdùàl/
 68. ẹ̀rábhàràbh nà òbhàbhànyà /ẹ̀rábàràḅ nẹ̀ òbàbànyà/
 69. ẹ̀rábhàràbh nà ẹ̀sùghó /ẹ̀rábàràḅ nẹ̀ ẹ̀sùyó/
 70. ẹ̀rábhàràbh nà dīòbh /ẹ̀rábàràḅ nẹ̀ dīòḅ/ ‘sixty and ten’; ‘seventy.’
 71. ẹ̀rábhàràbh nà dīòbh nà ònín /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ ònín/
 72. ẹ̀rábhàràbh nà dīòbh nà ìwàl /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ ìwàl/
 73. ẹ̀rábhàràbh nà dīòbh nà ìsàr /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ ìsàr/
 74. ẹ̀rábhàràbh nà dīòbh nà ìnyà /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ ìnyà/
 75. ẹ̀rábhàràbh nà dīòbh nà òghò /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ òyò/
 76. ẹ̀rábhàràbh nà dīòbh nà òdìn /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ òdìn/
 77. ẹ̀rábhàràbh nà dīòbh nà òdùàl /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ òdùàl/
 78. ẹ̀rábhàràbh nà dīòbh nà òbhàbhànyà /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ òbàbànyà/
 79. ẹ̀rábhàràbh nà dīòbh nà ẹ̀sùghó /ẹ̀rábàràḅ nẹ̀ dīòḅ nẹ̀ ẹ̀sùyó/

4.1.3 The pivot numeral 40 (forty)

Upon counting to 40, subsequent numerals are then expressed as units or multiples of forty, and ẹ̀wálá /ẹ̀wálá/ is used in place of ẹ̀rúbàl /ẹ̀rúbàl/, to serve as the pivot for values between forty and four hundred. It means that the Abureni numerals ẹ̀rúbàl and ẹ̀wálá mean the same thing and carry the same value equivalent to the Arabic numeral 40 (forty). Larger numerals with values more than forty (40) are broken down into multiples of forty, with the remaining fraction expressed in terms of twenties, tens, and units of ten.

40: ẹ̀wálá /ẹ̀wálá/ ‘forty’, used to express multiples of forty.

80 ìwàl ẹ̀wálá /ìwàl ẹ̀wálá/ ‘two-forties.’

‘eighty’ = 2 x 40

100 = (2 x 40) + 20
 ìwàl èwálá nà àdùsùbh
 /ìwàl èwálá nè àdùsùβ/
 ‘two-forties and twenty.’

177 = (4 x 40) + 10 + 7
 ìnyà èwálá nà dìòbh nà òduàl
 /ìnyè èwálá nè dìòβ nè òdùèl/
 ‘four-forties and ten and seven.’

4.1.4 The pivot numeral 400

The numeral 400 (four hundred) is derived from multiplying forty by ten: (400 = 40 x 10). This fact plays a significant role in the counting system, especially in calculations involving large numbers with values above four hundred.

400: ònîr /ònîr/ ‘four hundred’

Upon counting to four hundred (400), subsequent numerals are then expressed as units or multiples of four hundred, and **ònîr** /ònîr/ serves as a pivot for values between four hundred and infinity. Such numerals are normally broken down into multiples of four hundred, with any remaining fraction further expressed in terms of forties, twenties, tens, and units of ten. Let us illustrate with the numerals 444, 503, 875, 1438 and 10,041 below:

444 = (1 x 400) + (1 x 40) + 4
 ònîr nà èrúbàl nà ìnyà
 /ònîr nè èrúbèl nè ìnyè/
 ‘four hundred and forty and four.’

503 = (1 x 400) + (2 x 40) + 20 + 3
 ònîr nà ìwàl èwálá nà àdùsùbh nà ìsàr
 /ònîr nè ìwàl èwálá nè ìsàr/
 ‘four hundred and two-forties and twenty and three.’

875 = (2 x 400) + 60 + 10 + 5
 ìwàl ònîr nà èrábhàràbh nù dìòbh nà òghò
 /ìwàl ònîr nè èráβàràβ nù dìòβ nè òyò/
 ‘two four-hundreds and sixty and ten and five.’

1438 = (3 x 400) + (5 x 40) + 20 + 10 + 8
 ìsàr ònîr nà òghò èwálá nà àdùsùbh dìòbh nà òbhàbhànyâ.
 /ìsàr ònîr nè òyò èwálá nà àdùsùß dìòß nè òßàßàjã/
 ‘three four-hundreds and five forties and twenty and ten and eight.’

10,041 = (25 x 400) + (1 x 40) + 1
 àdùsùbh nà òghò ònîr nà èrúbàl nà ònîn
 /àdùsùß nè òyò ònîr nè èrúbàl nè ònîn/
 ‘twenty-five four-hundreds and forty and one.’

16,064 = (40 x 400) + 60 + 4
 èrúbàl ònîr nà èràbhàràbh nà ìnyà
 /èrúbàl ònîr nè èràßàràß nè ìjè/
 ‘forty four-hundreds and sixty and four.’

4.1.5 Numerals beyond 400

Upon counting to four hundred, subsequent numerals are then expressed as units or multiples of four hundred, and **ónîr** serves as a pivot for values between four hundred and infinity.

160,000 = 400 x 400
 ònîr ònîr /ònîr ónîr/
 ‘four hundred four-hundreds.’

160,114 = (400) x (400) + (2 x 40) + 20 + 10 + 4
 ònîr ònîr nà ìwàl èwálá nà àdùsùbh dìòbh nà ìnyà
 /ònîr ónîr nè ìwàl èwálá nè àdùsùß dìòß nè ìjè/
 ‘four hundred four-hundreds and two forties and twenty and ten and four.’

Infinity (∞) ònù ówǎl bǒ
 /ònò ówǎl bǒ/
 ‘uncountable number’ or ‘infinity.’

4.2 The significance of numerals four (4), ten (10), forty (40) and four hundred (400)

There are four key numerals – four (4), ten (10), forty (40) and four hundred (400) – that act as significant reference points or pivots in the Abureni numeral system. From the above analysis, the numeral four (4) is considered the root upon which the Abureni numeral system is built. In mathematical and computing terms, the Abureni numeral system would be described as having the primary features of ‘base-4’ numeral system but using the 1st and 2nd indices of 10 (numerals 10 and 100 respectively), in the ‘base-10’ system as multipliers.

Table 1
An illustration of how Abureni numerals combine the features of
base-4 system and base-10

Abureni numeral	Gloss	Arabic numeral	
		Numeral	Index form in base-4 and base-10
òñî	‘one’	1	$4^0 \times 10^0$
ìnyà	‘four’	4	$4^1 \times 10^0$
èrúbàl	‘forty’	40	$4^1 \times 10^1 = (40)^1$
òñîr	‘four-hundred’	400	$4^1 \times 10^2 = (400)^1$
òñîr tá òñîr	‘four-hundred times four-hundred’	400×400 = 160,000	$4^2 \times 10^4$ = $(400)^2$
òñîr tá òñîr tá òñîr	‘four-hundred times four-hundred times four-hundred’	$400 \times 400 \times 400$ = 64,000.000	$4^3 \times 10^6$ = $(400)^3$
òñîr tá òñîr tá òñîr tá òñîr	‘four-hundred times four-hundred times four-hundred times four-hundred’	$400 \times 400 \times 400 \times 400$ = 25,600.000.000	$4^4 \times 10^8$ = $(400)^4$

4.3 The place of indices in Abureni numerals and the applicable rules

Abureni numerals in the region between zero and forty employ the numeral **10** as pivot, which follows the base 10 numeral system as in most African languages. The numeral 20 also acts as a midway pivot. However, when it is required to state numerical values in the region between 40 and 400, the numeral **40** becomes the pivot. Similarly, when it is required to state extremely high numerical values in the region between 400 and infinity, the numeral **400** becomes the pivot. It means that in this region, the combination of the numerals 400, 40, 20, 10 and units of 10 are used to derive a particular numerical value. For completeness, the

Abureni numeral system may be described to have primary features of ‘base-4’ with complements of ‘base-10’.

a) Rules for counting numerals in the region between zero and 40.

ònîñ /ònîñ/	1 =	$4^0 \times 10^0$ [note that $4^0 = 1$; $10^0 = 1$]
ìnyà /ìjñè/	4 =	$4^1 \times 10^0$
ḍìòbh /ḍìòβ/	10 =	$1(4^0 \times 10^1) = 1 \times 4^0 \times 10^1$
àḍùsùbh /èḍùsùβ/	20 =	$2(4^0 \times 10^1) = 2 \times 4^0 \times 10^1$
àḍùsùbh ḍìòbh /èḍùsùβ ḍìòβ/	30 =	$3(4^0 \times 10^1) = 3 \times 4^0 \times 10^1$
èrúbàl /èrúbàl/	40 =	$4(4^0 \times 10^1) = 4 \times 4^0 \times 10^1$

b) Rules for counting numerals in the region between 40 and 400.

èwálá /èwálá/	40 =	$1(4^1 \times 10^1) = 1 \times 4^1 \times 10^1$
ìwal èwálá /ìwàl èwálá/	80 =	$2(4^1 \times 10^1) = 2 \times 4^1 \times 10^1$
ìsàr èwálá /ìsàr èwálá/	120 =	$3(4^1 \times 10^1) = 3 \times 4^1 \times 10^1$
ìnyà èwálá /ìjñè èwálá/	160 =	$4(4^1 \times 10^1) = 4 \times 4^1 \times 10^1$
òghò èwálá /òγò èwálá/	200 =	$5(4^1 \times 10^1) = 5 \times 4^1 \times 10^1$
òdìn èwálá /òdìn èwálá/	240 =	$6(4^1 \times 10^1) = 6 \times 4^1 \times 10^1$
òḍùàl èwálá [òḍùèl èwálá]	280 =	$7(4^1 \times 10^1) = 7 \times 4^1 \times 10^1$
òbhàbhànyà èwálá /òβàβàjñà èwálá/	320 =	$8(4^1 \times 10^1) = 8 \times 4^1 \times 10^1$
ésùghò èwálá /ésùγó èwálá/	360 =	$9(4^1 \times 10^1) = 9 \times 4^1 \times 10^1$
Òñîr /òñîr/	400 =	$10(4^1 \times 10^1) = 10 \times 4^1 \times 10^1$

Note: the numeral 400 = 10 x 40. In the Abureni numeral system, **ḍìòbh èwálá** /ḍìòβ èwálá/, which is the ‘**tenth forty**’ in the series, is called **ònîr** (400).

c) Rules for counting numerals in the region between 400 and infinity (∞).

Ònîr /ònír/	400	=	1 (4 ¹ x 10 ²)	=	1 x 4 ¹ x 10 ²
ìwàl ònîr /ìwàl ònír/	800	=	2 (4 ¹ x 10 ²)	=	2 x 4 ¹ x 10 ²
ìsàr ònîr /ìsàr ònír/	1200	=	3 (4 ¹ x 10 ²)	=	3 x 4 ¹ x 10 ²
ìnyà ònîr /ìnyà ònír/	1600	=	4 (4 ¹ x 10 ²)	=	4 x 4 ¹ x 10 ²
òghò ònîr /òyò ònír/	2000	=	5 (4 ¹ x 10 ²)	=	5 x 4 ¹ x 10 ²
òdìn ònîr /òdìn ònír/	2400	=	6 (4 ¹ x 10 ²)	=	6 x 4 ¹ x 10 ²
òdùàl ònîr /òdùàl ònír/	2800	=	7 (4 ¹ x 10 ²)	=	7 x 4 ¹ x 10 ²
òbhàbhànyà ònîr /òbàbànyà ònír/	3200	=	8 (4 ¹ x 10 ²)	=	8 x 4 ¹ x 10 ²
ésùghò ònîr /ésùyó ònír/	3600	=	9 (4 ¹ x 10 ²)	=	9 x 4 ¹ x 10 ²
dìòbh ònîr /dìòb ònír/	4000	=	10 (4 ¹ x 10 ²)	=	10 x 4 ¹ x 10 ²

ònîr ónîr /ònír ònír/ ‘four hundred four-hundreds’ = **400(400)**

ònîr tá ónîr (ònîr t’ónîr) /ònír t’ònír/ = 400 x 400 = 160,000

ònîr tá ónîr /ònír tó ónír/ ‘four hundred times four hundred’

$$= \mathbf{1}\{(4^1 \times 10^2)\}^2 = \mathbf{1}(4^2 \times 10^4) = \mathbf{1} \times 4^2 \times 10^4$$

$$= 160,000 = 1.6E + 5 \text{ (in standard form).}$$

(one hundred and sixty thousand)

ìwàl ònîr tá ónîr /ìwàl ònír tó ónír/

‘two four hundred four-hundreds’

$$= \mathbf{2}\{(4^1 \times 10^2)\}^2 = \mathbf{2}(4^2 \times 10^4) = \mathbf{2} \times 4^2 \times 10^4$$

$$= 320,000 = 3.2E + 5 \text{ (in standard form).}$$

(three hundred and sixty thousand)

ònîr ònîr ónîr /ònír ònír ónír/

‘four hundred four-hundred four-hundreds’

$$= \mathbf{(400)(400)(400)}$$

ònír tá ónír tá ónír /ònír tá ònír tá ónír/
‘four hundred times four hundred times four hundred’

$$\begin{aligned} &= 400 \times (400 \times 400) \\ &= \mathbf{1}\{(4^1 \times 10^2)\}^3 = \mathbf{1}(4^3 \times 10^6) = \mathbf{1} \times 4^3 \times 10^6 \\ &= 64,000,000 = 6.4E + 8 \text{ (in standard form)} \\ &\text{(sixty four million)} \end{aligned}$$

ìwàl ònír tá ónír tá ónír /ìwàl ònír tá ònír tá ónír/
‘two four hundred times four-hundred times four-hundreds’

$$\begin{aligned} &= 2 \times 400 \times (400 \times 400) \\ &= \mathbf{2}\{(4^1 \times 10^2)\}^3 = \mathbf{2}(4^3 \times 10^6) = \mathbf{2} \times 4^3 \times 10^6 \\ &= 128,000,000 = 1.28E + 8 \text{ (in standard form).} \\ &\text{(one hundred and twenty-eight million)} \end{aligned}$$

ònír ònír ònír ónír /ònír ònír ònír ónír/
‘four hundred four-hundred four-hundred four-hundreds’

$$= \mathbf{(400)(400)(400)(400)}$$

ònír tá ónír tá ónír tá ónír
/ònír ònír tá ònír tá ónír/

$$\begin{aligned} &= (400 \times 400) \times (400 \times 400) = 256,000,000 \\ &= \mathbf{1}\{(4^1 \times 10^2)\}^4 = \mathbf{1}(4^4 \times 10^8) = \mathbf{1} \times 4^4 \times 10^8 \\ &= 25,600,000,000 = 2.56E + 10 \text{ (in standard form).} \\ &\text{(twenty five billion six hundred million)} \end{aligned}$$

ìwàl ònír tá ónír tá ónír tá ónír
/ìwàl ònír tá ònír tá ònír tá ónír/
‘two four hundred times four hundred times four-hundred times four-hundreds’

$$\begin{aligned} &= \mathbf{2(400)(400)(400)(400)} \\ &= \mathbf{2}\{(4^1 \times 10^2)\}^4 = \mathbf{2}(4^4 \times 10^8) = \mathbf{2} \times 4^4 \times 10^8 \end{aligned}$$

= 51,200,000,000 = 5.12E + 10 (in standard form).
 (fifty one billion two hundred million)

òníṛ óníṛ óníṛ óníṛ óníṛ

/òníṛ òníṛ òníṛ òníṛ óníṛ/

‘four hundred four-hundred four-hundred four-hundred four-hundreds’

$$= 400(400)(400)(400)(400)$$

òníṛ tá óníṛ tá óníṛ tá óníṛ tá óníṛ

/òníṛ tá òníṛ tá òníṛ tá òníṛ tá óníṛ/

$$= 400 \times (400 \times 400) \times (400 \times 400)$$

$$= 1\{(4^1 \times 10^2)\}^5 = 1(4^5 \times 10^{10}) = 1 \times 4^5 \times 10^{10}$$

= 10,240,000,000,000 = 1.024E+13 (in standard form).
 (ten trillion two hundred and forty billion)

ìwàl òníṛ tá óníṛ tá óníṛ tá óníṛ tá óníṛ

/ìwàl òníṛ tá òníṛ tá òníṛ tá òníṛ tá óníṛ/

‘**two** four hundred times four-hundred times four-hundreds’

$$= 2(400)(400)(400)(400)(400)$$

$$= 2\{(4^1 \times 10^2)\}^5 = 2(4^5 \times 10^{10}) = 2 \times 4^5 \times 10^{10}$$

= 20,480,000,000,000 = 2.048E+13 (in standard form).
 (twenty trillion four hundred and eighty billion)

Tà òwàl òkúá òkúá títún **ònú ówâl bõ** /tə ówàl òkúá òkúá tótún ònò ówâl bõ/
 ‘The counting continues that way until **infinity**’

4.4 The concept of zero [0]

The Abureni compound word **òbhóbhò-ìkpò** /òbóbó íkpò/, meaning ‘nothingness,’ ‘void,’ ‘emptiness,’ etc., is used to represent the integer ‘zero’ [0]. It is known more as an expression of space, rather than an entity that features or carries any significant value in the Abureni numeral system.

4.5 Recurring numerals in the Abureni counting system

The study notes that certain numerals reoccur in the traditional counting system. There are fifteen of such numerals which are the most significant reference numerals in the Abureni numeral system.

Table 2
Recurring numerals in the Abureni traditional counting system

1. onin [òníń]	6. odin [òdín]	20. ȁḍusubh [əḍùsúβ]
2. iwál [iwàl]	7. oḍuál [òḍùèl]	40. erubál [èrúbèl]
3. isàr [isàr]	8. oḅhabhanya [əḅàḅàḅà]	40. ȁwala [èwàlá] (a multiple of 40 used for large numbers greater than 40)
4. inyà [ìḅhè]	9. esughò [ésùyó]	60. erabharabh [èràḅàràḅ]
5. oghò [òyò]	10. ḍiobh [ḍìòḅ]	400. ȁnîr [òḅîr]

4.6 Points of synergy between the Abureni counting system and base-10

Analogy could be drawn in the usage of pivot numerals as multipliers to derive high numerical values with respect to the numeral ‘400’ in Abureni counting system, and numeral ‘1000’ in the base-10 system. **Ȑnîr**, which is the numeral 400 in Abureni counting system under base-4, may be considered analogous to the way ‘**one thousand**’ (1000) functions in stating large numerals in the English counting system under base-10. Another point of synergy is the cyclic nature in which the multiples of the pivotal numerals are derived in the counting of large numbers. This plays an important role in the modelling of a base-10 version of the indigenous counting system of Abureni.

Table 3

An analogy between the use of numeral 400 in the Abureni traditional counting system and numeral 1,000 in the base-10 system in deriving high numerical values

Abureni traditional counting system: Use of 400 as pivot to derive high numerical values		
Ȑnîr	$1 = 4^0$	$4^0 \times 10^0$

ìnyà	$4 = 4 \times 1$	$4^1 \times 10^0$
èrúbàl	$40 = 4 \times 10$	$4^1 \times 10^1$
ònr̄	$400 = 4 \times 100$	$4^1 \times 10^2 = (400)^1$
ònr̄ tá ònr̄	400×400	$4^2 \times 10^2 = (400)^2$
ònr̄ tá ònr̄ tá ònr̄	$400 \times 400 \times 400$	$4^3 \times (10^2)^3 = (400)^3$
ònr̄ tá ònr̄ tá ònr̄ tá ònr̄	$400 \times 400 \times 400 \times 400$	$4^4 \times (10^2)^4 = (400)^4$
English (international): Use of 1,000 to derive high numerical values in base-10 (analogy)		
One	1	10^0
Ten	$10 = 10 \times 1$	10^1
one hundred	$100 = 10 \times 10$	10^2
one thousand	$1,000 = 10 \times 100$	$10^3 = (1000)^1$
one million	$1,000,000 = 1000 \times 1000$	$10^6 = (1000)^2$
one billion	$1,000,000,000$ $= 1000 \times 1000 \times 1000$	$10^9 = (1000)^3$
one trillion	$1,000,000,000,000$ $= 1000 \times 1000 \times 1000 \times 1000$	$10^{12} = (1000)^4$

4.7 The base-10 method of counting numerals in Abureni

The difficulty in counting beyond four hundred has been highlighted. There is no specific single numeral that describes any value beyond four hundred in Abureni (other than its multiples). From four hundred, the process of counting is achieved by addition and multiplication in various forms. So, it continues till infinity. As the numbers increase, the counting process becomes more complex and unimaginable from the numeral data that has been analysed.

Therefore, it becomes necessary to consider adopting the method of counting in the modern world where large numbers are derived from multiples of 10. The approach is to apply the base-10 system of counting, using Abureni linguistic terminology.

Table 4

A model of Abureni numerals in base-10 with illustration of meanings using indices for values of 1,000 and below

Base-10 numerals	Abureni numeral in base-10 terms	Base-10 numerals in indices	Meaning in Abureni
1. one	onin [ònr̄n̄]	10^0	ònr̄n̄
10. ten	ḍiobh [ḍìòḅ]	10^1	ḍiòḅ ònr̄n̄ ìg'èl

20. twenty	ìwal ñiobh [ìwàl ñìòβ]	2*10 ¹	ìwàl ñìòβ
30. Thirty	ìsar ñiobh [ìsàr ñìòβ]	3*10 ¹	ìsàr ñìòβ
40. forty	ìnya ñiobh [ìnyà ñìòβ]	4*10 ¹	ìnyà ñìòβ
50. fifty	oghò ñiobh [òyò ñìòβ]	5*10 ¹	òyò ñìòβ
60. sixty	òdìn ñiobh [òdìn ñìòβ]	6*10 ¹	òdìn ñìòβ
70. seventy	òdùàl ñiobh [òdùàl ñìòβ]	7*10 ¹	òdùàl ñìòβ
80. eighty	òbhabhanya ñiobh [òbàbànyà ñìòβ]	8*10 ¹	òbàbànyà ñìòβ
90. ninety	ésùyó ñiobh [ésùyó ñìòβ]	9*10 ¹	ésùyó ñìòβ
100. one hundred	ñiobhñiobh [ñìòβñìòβ]	10 ²	ñìòβ ìwàl ìg'èl
200. two hundred	ìwal ñiobhñiobh [ìwàl ñìòβñìòβ]	2*10 ²	ìwàl ñìòβñìòβ
300. three hundred	ìsar ñiobhñiobh [ìsàr ñìòβñìòβ]	3*10 ²	ìsàr ñìòβñìòβ
400. four hundred	ìnya ñiobhñiobh [ìnyà ñìòβñìòβ]	4*10 ²	ìnyà ñìòβñìòβ
500. five hundred	ñiobhñiobh [òyò ñìòβñìòβ]	5*10 ²	òyò ñìòβñìòβ
600. six hundred	ñiobhñiobh [òdìn ñìòβñìòβ]	6*10 ²	òdìn ñìòβñìòβ
700. seven hundred	òdùàl ñiobhñiobh [òdùàl ñìòβñìòβ]	7*10 ²	òdùàl ñìòβñìòβ
800. eight hundred	òbhabhanya ñiobhñiobh [òbàbànyà ñìòβñìòβ]	8*10 ²	òbàbànyà ñìòβñìòβ
900. nine hundred	ésùyó ñiobhñiobh [ésùyó ñìòβñìòβ]	9*10 ²	ésùyó ñìòβñìòβ
1,000. one thousand	ñiobhñiobhñiobh [ñìòβñìòβñìòβ]	10 ³	ñìòβ ìsàr ìg'èl

Table 5

A model of Abureni numerals in base-10 with illustration of meanings using indices for values above 1,000

Base-10 numerals	Base-10 numerals in Abureni	Indices	Meaning in Abureni
10,000. ten thousand	ñiobh ñiobhñiobhñiobh [ñìòβ ñìòβñìòβñìòβ]	10 ⁴	ñiobh ìnya ìgiel [ñìòβ ìnyà ìg'èl]
100,000. one hundred thousand	ñiobhñiobh ñiobhñiobhñiobh	10 ⁵	ñiobh oghò ìgiel [ñìòβ òyò ìg'èl]
1,000,000. one million	ñiobhñiobhñiobh ñiobhñiobhñiobh	10 ⁶	ñiobh òdìn ìgiel [ñìòβ òdìn ìg'èl]
1,000,000,000 one billion	ñiobhñiobhñiobh ñiobhñiobhñiobh ñiobhñiobhñiobh	10 ⁹	ñiobh esùyó ìgiel [ñìòβ ésùyó ìg'èl]

1,000,000,000,000 one trillion	ḍiobhḍiobhḍiobh ḍiobhḍiobhḍiobh ḍiobhḍiobhḍiobh ḍiobhḍiobhḍiobh	10 ¹²	ḍiobh ḍiobh nà iwàl igièl [ḍiòḍ ḍiòḍ nà iwàl igièl]
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Table 6

The powers of the numeral 10 (ten) expressed in Abureni terminology

ten	10	ḍiòbh (ḍiòbh ònîn-igièl)
one hundred	100	ḍiòbh iwàl-igièl
one thousand	1,000	ḍiòbh isàr-igièl
ten thousand	10,000	ḍiòbh ìnyà-igièl
one hundred thousand	100,000	ḍiòbh òghò-igièl
one million	1,000,000	ḍiòbh òdîn-igièl
ten million	10,000,000	ḍiòbh òdùàl-igièl
one hundred million	100,000,000	ḍiòbh òbhàbhànyâ-igièl
one billion	1,000,000,000	ḍiòbh èsúghò-igièl
ten billion	10,000,000,000	ḍiòbh ḍiòbh-igièl
one hundred billion	100,000,000,000	ḍiòbh ḍiòbh nà ònîn-igièl
one trillion	1,000,000,000,000	ḍiòbh ḍiòbh nà iwàl-igièl
ten trillion	10,000,000,000,000	ḍiòbh ḍiòbh nà isàr-igièl
one hundred trillion	100,000,000,000,000	ḍiòbh ḍiòbh nà ìnyà-igièl
one thousand trillion	1,000,000,000,000,000	ḍiòbh ḍiòbh nà òghò-igièl
ten thousand trillion	10,000,000,000,000,000	ḍiòbh ḍiòbh nà òdîn-igièl
one hundred thousand trillion	100,000,000,000,000,000	ḍiòbh ḍiòbh nà òdùàl-igièl
one million trillion	1,000,000,000,000,000,000	ḍiòbh ḍiòbh nà òbhàbhànyâ-igièl
one billion trillion	1,000,000,000,000,000,000,000	ḍiòbh àḍusúbh nà ònîn-igièl
one trillion trillion	1,000,000,000,000,000,000,000,000	ḍiòbh àḍusúbh nà ìnyà-igièl

4.8 Applications of base-10 and potential benefits to Abureni

An example of base-10 application is the metric system of measurement in metres, which so many countries presently use for linear dimensions, compared to the Imperial System that measures in feet. According to Meleen (2021) the metric system is better in today's world because it is an almost universal standard that is easier to use because of the way the measurements relate to each other as multiples of 10. Even for large linear measurements in the Imperial System, it is easier to apply the principles of base-10 than the traditional counting system. For example, let us compare the way the distance of one mile would be measured in the Abureni traditional counting system and in base-10 format.

Basis: 1 mile is equivalent to 880 (eight hundred and eighty) fathoms. In Encyclopaedia Britannica (2013), a fathom is measured to be 6 feet (1.83 metre), “the longest of many units

derived from an anatomical measurement,” and that it “originated as the distance from the middle fingertip of one hand to the middle finger of the other hand of a large man holding his arms fully extended.”

The length of one **fathom** of cloth is six (6) feet.

òníń ékùdí úkpè /òníń ékùdí úkpè/ ‘one fathom of cloth’ (common knowledge in Abureni).

àkùbù /àkùbù/ ‘fathom’

òníń **àkùbù** /òníń àkùbù/ ‘one fathom (6 feet)’

one mile (880 **fathoms**)

ìwàl òníń nà ìwàl èwàlá ákùbù /ìwàl òníń nà ìwàl èwàlá ékùbù/
‘two four-hundreds and two-forties **fathoms**’

= [(2 x 400) + (2 x 40)] **àkùbù**

In base-10 terms, one mile (880 fathoms) will be translated as:

òbhàbhànyà dìòbh dìòbh nà òbhàbhànyà dìòbh ákùbù
/òβàβàŋà dìòβ dìòβ nà òβàβàŋà dìòβ àkùbù/

‘eight ten-tens and eight tens **fathoms**’

= [8(10²) + 8(10¹)] **àkùbù**

5. Challenges and corrective actions

- a) Resistance to change over the introduction of the base-10 counting system, and fear of replacing or losing the indigenous counting system. Such concerns have been expressed in similar works over the potential impact of the decimal system on the indigenous method of counting if it is not adapted appropriately. In Urua et al (2020:245), Awoyale observes with a poser: “Given the technological advantage of the decimal system, would that lead to the demise of the traditional system?” It ought not result to that.
- b) Learning and teaching of Base-10 as an alternative counting system will take time for it to be embedded as a tool of the modern day.

- c) Lack of teachers on the indigenous language itself as Abureni language is still at the early stage of documentation.
- d) Presently, some native speakers are not able to competently count in the traditional method, especially among the young generation. They first need to understand the indigenous counting method before learning new ideas, such as the base-10 counting system.

6. Recommendations

Based on the results of the study, it is recommended that:

- a) Awareness should be created concerning the benefits of base-10 and its application, using examples in the computation and business environment of today. The decimal system should be established and tested side-by-side with the indigenous counting system, while emphasizing the need to sustain the latter as a cultural heritage.
- b) The learning and teaching of base-10 counting system should be included in the scope of the Abureni Documentation and Advocacy Project, and in the school curricula.
- c) The train-the-trainer strategy should be adopted in identifying and training teachers on both the indigenous and base-10 counting systems.
- d) The base-10 counting system should be included in the indigenous language curriculum while developing learning templates that would address specific applications across age groups.

7. Conclusion

The analysis shows that there are points of synergy between the Abureni traditional counting system and that of base-10. Translating the numerals to the indigenous language helps to bring out their meanings for better understanding of the features of the new system. One principal point of synergy is the numeral 10 (ten), which appears as a fundamental cyclic unit in both systems. The second feature is that both systems use pivotal numerals which serve as reference points to derive larger numbers. The idea of performing addition or subtraction or multiplication operations on figures is inherent in the traditional system that was investigated.

This paper is of the view that it is possible to produce a base-10 model for a language without disrupting the indigenous numbering pattern. This means that the traditional counting system and its base-10 counting model should be treated as separate but related counting

systems of the language in question. It is anticipated that this work would be seen as an attempt to contribute to the discourse on the impact of globalization on indigenous languages, especially on numeral systems.

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