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| **Title:** | | “New and emerging technologies” proposed new Resolution from C113 | |
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| **Abstract:** | This document contains a proposed new Resolution on “New and emerging technologies” from C113 for TSAG to add to its report for further discussions at WTSA24. |

This document contains a proposed new Resolution on “New and emerging technologies” from C113 for TSAG to add to its report for further discussions at WTSA24.

The proposed new Resolution on “New and emerging technologies” from C113 is in Annex A and the rationale from C113 is on Annex B which is itself supported by an Annex C.

Notes and considerations from the discussion:

* This is a new proposal that is shared at a late stage of a very short study period and requires time for reflection.
  + Response: This is in line with the intention of this proposal to engage TSAG members to participate on what will be a long endeavour and confirms the need to start now taking TSAG and WTSA24 as two opportunities to get feedback and build the necessary momentum for a good start with the new study period.
* There is a proposal to consider adding industry representatives into this entity:
  + Response: This is a good idea but will require a representativity mechanism to be agreed, with various options.
* There is an expressed view that C104 is addressing an important definition issue which creates a dependency to this work
  + Response: The definition issue is already part of this proposed new resolution and in fact on the entire term “new and emerging telecommunication/ICTs” as showing in ‘instructs TSAG, TSB and SCV’ in Annex A.
  + The dependency it creates is recognized as part of the design of the mechanism itself and should not prevent to progress of other higher level issues such as requirements, constraints, limits and study potential candidates to fulfil the mechanism that Resolution 22 requests.
  + This new Resolution proposal would benefit from considering the outcomes of C104.
* There is an expressed view that this effort will require steps and prototyping
  + Response: This will indeed require multiple steps and a prototyping phase
* There is a remark that in proposed resolve 2, calling out TSB counsellors doesn’t look correct
  + Response: indeed, this is incorrect and Annex A is trying to fix it
* There is an expressed view that this is not only a concern for the T sector but for all the ITU
  + Response: This may indeed be the case and may need to be addressed too but this current proposal was designed within the scope of ITU-T.
* Some participants confirmed their intention to engage on this project.

Annex A – Proposed new Resolution

NEW RESOLUTION DEFINITION OF NEW AND EMERGING TECHNOLOGIES

World Telecommunication Standardisation Assembly (New Delhi, 2024)

considering

a) that Resolution 22 (Rev. Geneva, 2020) of the World Telecommunication Standardisation Assembly (WTSA), on the Authorization or the Telecommunication Standardisation Advisory Group to act between world telecommunication standardisation assemblies, resolves that TSAG establishes a mechanism for ITU-T’s standardization development strategies and for the examination of their (new and emerging telecommunication/ICTs) consideration;

b) that Resolution 68 (Rev. Geneva, 2020) of the World Telecommunication Standardisation Assembly (WTSA), on the Evolving role of industry in the ITU Telecommunication Standardization Sector, allows CTO and/or CxO group meetings to engage discussions on new and emerging telecommunication/ICTs;

considering further

a) that TSAG agreed a vibrant industry engagement action plan which delivered its first workshop,

b) that the TSAG industry engagement workshop demonstrated the issue of the relevance of market needs need to be represented clearly and succinctly as context for new and emerging telecommunication/ICTs,

recognizing

1. that new and emerging telecommunication/ICTs and its associated terminologies were never defined at the ITU-T,
2. that new and emerging telecommunication/ICTs should be placed in the context of market needs, assuming there should be no duplication of work with other SDOs, inter sector coordination is in place and to the extent similar work is being studied, there is complementarity between ITU-T and other SDOs.
3. that there is a very broad list of new and emerging telecommunication/ICTs,
4. that the list of new and emerging telecommunication/ICTs and their synonyms are not qualified, making consensus more complicated to be reached,
5. that synonyms of new and emerging telecommunication/ICTs are spanning through a significant number of ITU-T Resolutions, making it difficult to establish a mechanism to manage them,
6. that a concept of standardisation readiness status is missing at the ITU-T which could establish if a new and emerging technology,
7. that new and emerging telecommunication/ICTs follow specific and potentially very different innovation lifecycles,
8. that innovation lifecycles were studied at different periods over the past decades,
9. that innovation lifecycles were not studied in the past decade,
10. that the identification of a new and emerging telecommunication/ICTs in its own innovation lifecycle contributes to the identification of their standardisation readiness status at the ITU-T,
11. that new and emerging telecommunication/ICTs can be characterised in different ways and would require precise metadata to define them in the context of the ITU-T,

resolves

1) for new and emerging telecommunication/ICTs that are relevant for market needs, assuming there should be no duplication of work with other SDOs, inter sector coordination is in place, and to the extent similar work is being studied, there is complementarity between ITU-T and other SDOs, to be handled in a uniform manner by and across the ITU-T, either by TSAG or during World Telecommunication Standardization Assemblies,

1. for new and emerging telecommunication/ICTs to be defined with the appropriate list of attributes to be managed by the mechanism that Res. 22 specifies TSAG to establish,
2. for TSAG to define a non-decisional entity to which it delegates the examination of new and emerging telecommunication/ICTs, and which prepares a report back to TSAG with its recommendations for decisions,
   1. that this entity should consist of the study group chairs, TSB director and/or deputy director, industry representatives, TSB staff in charge of the new and emerging supporting tools, and one delegate chosen among the membership by each of the six ITU-T regions,
   2. that study group chairs can consult within their study groups for consensus and positions on any new and emerging technologies in focus,
   3. that TSAG should develop a new A series Recommendation to agree and specify all the modalities of this new entity,
   4. that this entity should provide its report one month before each TSAG meeting,

instructs TSB, TSAG and SCV

1) to agree and maintain/update a definition of new and emerging telecommunication/ICTs and its associated required terms, within the mandate of the ITU-T,

instructs TSB

1. to establish and maintain a tool discovering, identifying and registering all qualified new and emerging telecommunication/ICTs and their complete metadata in order to support their examination by the above entity which will implement one aspect of the mechanism stipulated by Resolution 22, in particular to prioritize those that require decisions by TSAG.
2. to use the results of the above entity as input to prepare the CTO/CxO meetings specified by Res. 68, thus ensuring coherency on new and emerging telecommunication/ICTs across the sector.

Annex B – Rationale

# Conventions

In this contribution:

* “Res. 22” will refer to Resolution 22, Rev. Geneva, 2022),
* “Res. 68” will refer to Resolution 68, Rev. Hammamet, 2016).

# Introduction

Broadcom proposes to go one step further on the execution of the instruction 3 from the [ToR of RG-IEM](https://www.itu.int/en/ITU-T/tsag/2022-2024/Pages/Rapporteur-Groups.aspx#RG-IEM).

*Establish an appropriate mechanism at TSAG level to be used at the study group level and at the Focus group level to examine and coordinate work on new and emerging technologies (Res.22 resolves 5, 6, 7).*

As per contributions [1] [TSAG-C31](https://www.itu.int/md/T22-TSAG-C-0031/en) and [2] [TSAG-C84](https://www.itu.int/md/T22-TSAG-C-0084/en), Broadcom would like to analyse issues that are intimately connected to each other:

* How to define ‘new and emerging technologies’?
* How to define the term ‘examination’ in the Resolve 5 of Res. 22?

Then Broadcom would like to propose alternatives to fix these issues as a pre-requisite and propose a first design for a mechanism as requested by instruction 3 to RG-IEM.

This contribution will particularly recall:

* [1]: Annex A.2 and Annex B, and Annex A.3,
* [2]: Sections 2 and 3.2.

# Analysis

There are multiple ways to look at ‘new and emerging technologies’ but in the ITU-T context our objective is to understand:

* How to identify a ‘new and emerging technologies’ with the goal to capture it into a tool to support its examination over time?
* How to establish which lifecycle a given ‘new and emerging technology’ is following?
* How to support decisions of TSAG on identifying in which stage is a ‘new and emerging technology’ in its lifecycle?

## Identification of the context

Not to repeat the analysis of [1] Annex A.1, that the context is:

* “within market needs”,
* for new and emerging technologies “that have not yet been considered for standardisation by ITU-T”,
* “… assuming a) inter sector coordination is in place, b) there should be no duplication of work with other SDOs” and c) to the extent similar work is being studied, there is complementarity between ITU-T and other SDOs.

## Identification of ‘new and emerging technologies’

Not to repeat the analysis of [1] Annex A.2 and Annex B, there are many alternatives for the term ‘new and emerging technologies’.

There are several difficulties to agree the definition of this term but at the same time it is essential to invest time as there are needs for:

* each new and emerging technology name be unique and well categorised,
* that for each new and emerging technology, the appropriate metadata, attributes and descriptors be established to allow tools to support this mechanism.

## Identification of ‘new and emerging technologies’ lifecycle

Annex C regroups research on a number of ‘new and emerging technologies’ lifecycles.

This highlights that

* there are diverse approaches to innovation lifecycles,
* that it seems it is a long time (more than a decade) that no new major study was delivered in this area.

## Identification of ‘new and emerging technologies’ standardisation stages

A given topic of so-called ‘new and emerging technologies’ can be in various standardisation readiness status, taking an ITU-T point of view.

The topic is (for example)

* ‘new and emerging technologies’
  + in research level,
  + in the industry,
* Standardisation
  + pre-standardisation
    - but premature for standardisation,
    - but not at the ITU,
    - for the ITU-T,
  + standardisation
    - not for the ITU,
    - for the ITU-T,
* coordination states
  + requires coordination between SDOs,
  + requires coordination within the ITU,
  + requires coordination within the ITU-T.

## Recognizing that new and emerging technologies cannot be managed during TSAG meetings

Bearing in mind that there are dozens if not hundreds of new and emerging technologies it is practically impossible for TSAG to manage the whole range of issues of new and emerging technologies during its meetings.

It requires a non-decisional ‘delegation’ mechanism to be incarnated by an entity with the right composition of:

* Study Group chairs,
* TSB leadership and operational staff in charge of the tooling supporting the mechanism,
* A membership representation (one delegate per region).

This entity should examine (Res. 22 terminology) new and emerging technologies with the right prioritisation, supported by TSB tooling, and with consultations of the study groups in order to provide prioritised recommendations for TSAG to decide at its meetings.

This should be codified with a new A series Recommendation.

# Alternatives and options

## Proposition 1 – Modify Res. 22

A first approach consists in making modifications to Res. 22.

This approach has pros and cons:

* Pros: It is pragmatic and easier to modify an existing Resolution,
* Cons: But this is heavily cluttering and unbalancing the Resolution, bringing all the language needed to start covering new and emerging technologies correctly and in order to prepare one part of the mechanism required by resolves 5, 6 and 7 of Res. 22

Broadcom position is that whilst pragmatic, this approach doesn’t seem reasonable, therefore Broadcom makes a second proposition below:

## Proposition 2 – Proposition to establish a new Resolution

A second approach consists in proposing a new Resolution on new and emerging technologies. See Annex A.

This is a very good investment for the future, allowing finally to start the establishment of a mechanism as per Res. 22 but will allow as well further streamlining of many of the T sector resolutions, mindful that many of them, have new and emerging technologies synonyms in their operative part.

## Proposition 3 – Develop a new A series Recommendation

The third approach (not started here) consists in preparing a contribution for a New Work Item as a new A series Recommendation to define this new entity.

This approach is complimentary to the 2 previous propositions and can be developed on a different timescale, e.g. in the next study period.

# Proposals

Broadcom would like to:

* discuss this contribution and get TSAG feedback on each alternative,
* request TSAG the possibility to submit this contribution and its attachments to WTSA24 with the stated goal
  + to broaden the discussion at the assembly, considering other contributions to modify e.g. Res. 22, Res. 68
  + document the feedback received in terms of concerns, requirements, etc.
  + and thus, in the next study period, put TSAG in a good position to pursue the development of the mechanism requested by Res. 22
* encourage TSAG members and in particular ITU Regions to consider and embrace this proposal and support them to present this draft new Resolution at WTSA24.

Annex C – Research on innovation models and lifecycles

This annex regroups research on ‘new and emerging technologies’ and innovation models and lifecycles.

**A.1 Evolutionary view of innovation models and lifecycles**

The understanding and modeling of how new and emerging technologies are adopted and evolve have been shaped by several key theories since the 1960s. These models and theories provide frameworks for analyzing the diffusion, acceptance, and maturity of innovations across various sectors. The below shows some non-exhaustive evolution of these theories:

1. Diffusion of Innovations Theory (1962)

Developer: Everett Rogers

Concept: This theory classifies adopters into five categories: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards, based on their speed of adoption of new technologies. It emphasizes the influence of social systems, communication channels, and the time it takes for a new idea or product to be adopted.

2. Technology Adoption Life Cycle (TALC) (Late 1950s - Early 1960s)

Developers: Joe M. Bohlen, George M. Beal, and Everett Rogers

Concept: Initially applied to the adoption of agricultural innovations, it was later generalized to other domains. TALC focuses on the sociological characteristics of adopter groups and has been pivotal in marketing strategies, especially in the technology sector.

3. Moore's Law (1965)

Developer: Gordon Moore

Concept: Not a theory of adoption per se, but a predictive tool for the pace of technological progress in the semiconductor industry, stating that the number of transistors on a chip doubles approximately every two years, thus predicting a rapid growth in computing power.

4. Gartner's Hype Cycle (1995)

Developer: Gartner, Inc.

Concept: This model provides a graphical representation of the maturity, adoption, and social application of specific technologies. It identifies five phases from a technology trigger to a plateau of productivity, helping stakeholders understand the likely evolution and relevance of technologies.

5. Crossing the Chasm (1991)

Developer: Geoffrey A. Moore

Concept: This theory refines the TALC for high-tech markets, identifying a significant gap or "chasm" between early adopters and the early majority. It highlights the distinct challenges faced by innovative products in gaining broader market acceptance.

6. McKinsey's Three Horizons of Growth (Late 1990s)

Developers: McKinsey & Company

Concept: This framework is used for managing a company’s growth strategies over time, balancing focus between current performance and future opportunities. It helps companies plan their innovation strategy across "now," "new," and "next" horizons.

7. Lean Startup Methodology (2008)

Developer: Eric Ries

Concept: Although not a model of adoption, it's a methodology that affects how technologies and products are developed and iterated based on real-world feedback. It emphasizes quick, agile development cycles, validated learning through customer feedback, and "pivoting" or changing course based on this feedback.

These theories and models provide a multidimensional view of how technologies penetrate and mature in markets. They offer tools for businesses and policymakers to forecast technological trends, plan product development, manage risk, and optimize resources throughout the lifecycle of innovations.

**A.2 The specific case of AI**

Now if we look at the development of Artificial Intelligence (AI), discussing it in terms of "waves" or "eras" is a useful way to understand its evolution, particularly because AI's progress has been characterized by alternating periods of high optimism and significant achievements followed by setbacks and reduced funding, known as "AI winters."

First Wave: The Birth of AI (1950s - 1970s)

Origins and Early Optimism: The term "Artificial Intelligence" was coined by John McCarthy in 1956 during the Dartmouth Conference. This period was marked by the belief that machines could soon be made to simulate all aspects of human intelligence.

Key Developments: Early work focused on problems like game playing, problem solving, and theorem proving. Notable programs from this era include IBM’s Deep Blue and ELIZA, an early natural language processing program.

AI Winter (Late 1970s - Early 1980s)

Reasons for Decline: The first AI winter occurred due to inflated expectations, lack of computational power, and difficulties in handling non-linear problems, leading to reduced funding and interest.

Second Wave: Knowledge-based Systems (1980s - 1990s)

Rise of Expert Systems: This era saw the development of systems that could store knowledge and make inferences, such as medical diagnosis systems and financial decision-making tools.

Technological Advancements: Advancements in computational power and storage, alongside the development of more sophisticated algorithms, fueled growth.

AI Winter (Late 1980s - Early 1990s)

Causes: Once again, the limitations of AI technologies, particularly the scalability and maintenance of expert systems, led to disillusionment.

Third Wave: Machine Learning & Deep Learning (2000s - Present)

Revitalization with New Approaches: The resurgence of AI was driven by advances in machine learning and particularly deep learning, enabled by more powerful hardware (GPUs), big data, and improved neural network techniques.

Broad Applications: AI applications have expanded vastly, impacting fields from autonomous vehicles and healthcare to finance and customer service.

Looking Ahead

Continued Expansion and Ethical Considerations: AI continues to advance, with increasing focus on issues like ethics, bias, transparency, and the societal impacts of automation and decision-making systems.

This characterization of AI's history shows that while AI did not follow the traditional technology adoption cycles or hype cycles exactly, its development can still be understood through a similar lens of expectations, achievements, and setbacks. Each wave of AI brought new technologies, theories, and applications, influenced by both the technological landscape and the socio-economic conditions of the time.

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