Research

Foresight, Forecast and Futurology in Reverse: Towards Cultural Sustainability via STEAM

Istileulova Yelena [1,*], Mukhamejanova Larissa[2]

1. Faculty of Health Sciences, University of Ljubljana, Slovenia
2. University of International Business (UIB), Marketing/Branding, Kazakhstan

* Correspondence: yelena.istileulova@zf.uni-lj.si or yelena.istileulova@fulbrightmail.org;

Citation: Istileulova Y, Mukhamejanova L. Foresight, Forecast and Futurology in Reverse: Towards Cultur-al Sustainability via STEAM. Proceedings of Socratic Lectures. **2025**, 13, 107-116. https://doi.org/10.55295/PSL.13.2025.13

Publisher's Note: UL ZF stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract:
The overall focus of this discussion is the integration of STEAM (Science, Technology, Engineering, Arts, Mathematics) approaches into future thinking, structured around three key dimensions. First, it examines the conceptual distinctions between foresight, forecasting, and futurology, highlighting how each concept frames the anticipation of the futures in different ways. Second, it introduces a reverse approach through the concept of "Retrosight" - a perspective in which alternative futures are not projected linearly but imagined creatively via art-based STEAM practices. It explores the SMS (Stories based on Music about Scientists) method (STEAM approach), which involves composing original music based on poems written by scientists (17th-20th centuries), poetry or musical compositions dedicated to them with digital images. SMS is a narrative method that integrates music and storytelling to humanize scientific futures and reconnect with enduring questions. Third, the discussion illustrates how creative methods can be applied in practice - through illustrated art experiments that map uncertainty and reframe how we approach complex future challenges. The role of science, education, and planetary health is central to this exploration, drawing on original SMS compositions using poetry by James Maxwell, Francis Bacon, and Alfred Nobel. These SMS songs offer a creative lens through which to explore questions still relevant today with philosophical and scientific concern. As recognized by the WHO (World Health Organisation) and the European Commission, Art is essential not only for health and homeostasis, but it serves as a key component of cultural sustainability. STEAM-based SMS experiments can be ideally applied to futures studies from a management perspective grounded in framework of Retrosight.

Keywords: Cultural sustainability; Management perspective; Futures studies; Stories based on Music about Scientists; Retrosight; STEAM

1. Introduction

1.1. SMS method as a STEAM approach: definition

This paper builds on research into the Foresight through STEAM approach with a focus on the role of Art practices. It aims to develop foresight´s alternative models using the SMS method (Stories based on Music about Scientists) as STEAM approach introduced in previous research publications (Istileulova, 2023). In short, the SMS method, which emerged in 2012, combines three elements of storytelling: (1) music, (2) poetry (written by scientists or about scientists of the past), and (3) image.

Thus, this paper includes the art-innovative practices of STEAM approach applied in Foresight with:

1. Original music (composed specifically for the poem)
2. Poems written by scientists (from the 17th to 20th centuries), or poetry dedicated to notable scientists, based on historical or biographical research
3. Digital visual images, such as videos, drawings, pictures, engravings, photos, etc

Thus, SMS is a narrative method that integrates music, poetry, and visual imagery about scientists to inspire innovation.

We can say that SMS is a story-singing to humanize scientific futures and reconnect with enduring questions. While grounded in scientific research, the method also allows space for poetic imagination, weaving fact with interpretation to create emotionally resonant narratives. The method uses the Art to connect the past with the present and to explore ideas about the future - and, in reverse, to reimagine the past through the lens of future possibilities.

What distinguishes this method (for instance, from songs) is that the poetic narrative is grounded in original research: each story is based on research constructed from historical, biographical, and conceptual study of selected scientists and their work.

The story-singing is primarily written in English and Russian, with some texts available in other languages (examples: https://www.youtube.com/@aleona_von_sultanova).

Next, we introduce the concept of foresight as a multidisciplinary function to further illustrate how it can be leveraged within the SMS method.

1.2. Foresight as a multidisciplinary function

Foresight as a multidisciplinary function

Foresight is rooted in an American technological forecasting or tradition; which was mainly developed in relation to strategic military studies at the RAND (Research and Development Corporation) in the USA during the 1940s and 1950s (Jantsch, 1967). Jantsch's 1967 work is often seen as the conceptual starting point for institutional foresight. The RAND, an American nonprofit global policy think tank, research institute, and public sector consulting firm expanded its research into civilian fields: education and international affairs. The 1972 report "The Limits to Growth" by the Club of Rome (Meadows et al., 1972), a global think tank headquartered in Switzerland, used systems analysis and modelling to forecast environmental and economic challenges, and highlighted the importance of long-term planning and foresight.

David Fidler (2011) approaches foresight not just as a futures-thinking tool, but as a multidisciplinary, strategic function integrated across several fields - especially from a strategic management perspective.

Fidler (2011) considered that the growth of Foresight or Futures Studies as a discipline has been less robust than the internal logic of the field, indicating an opportunity for its theoretical renewal. Fidler´s foresight domains include strategic management, leadership, sustainability and corporate responsibility, innovation management, policy, governance, risk and resilience management, marketing and consumer insight, change and organizational learning, technology and R&D (Research and Development) strategy. "Foresight" can also be approached from various perspectives of branding, when we consider it as part of strategic marketing, cultural positioning and identity management or the Arts-related innovative practices within STEAM.

This theoretical renewal is suggested here with the Art-embedded methods of STEAM approach with the FFF (Foresight-Forecast-Futurology) triangle.

2. Literature: Foresight, Forecast and Futurology

An interesting fact is that while working on technology futures - under various labels such as "anticipation," "forecasting," and "futures studies" - I&M (Irvine and Martin) introduced the term "foresight", partly as a humorous counterpoint to "hindsight" (Miles, 2010). "Foresight" was just one among many words used to describe long-range forward-looking activities included in a list, known as "futures studies, futures research, futurology, futuristics, futurics, foresight, forecasting, prognostics" (Marien, 1984). FFF (Foresight, Forecast and Futurology) are three overlapping but distinct approaches in futures studies. They differ in their purpose, methods, and philosophical orientation. Forecasting answers: "What is most likely to happen?", Futurology answers: "What could happen?" or "What should happen?", and Foresight – "What is plausible, and how should we respond?" However, here we suggest defining all these concepts as FFF or 3F orientation, because SMS method can approach all three of them. Moreover, the need for all varieties of foresight are greater than at any point in history (Fidler, 2011; Miles, 2010).

In the book of a futurist Peter Schwartz (1997), "*Art of the long view: planning for the future in an uncertain world*", he also takes a holistic view, emphasizing the power of storytelling: he explores aspects of scenario planning and draws insights from disciplines such as anthropology, history, geopolitics, fiction writing, music, and other fields accessible to an intellectually curious mind. He discusses how artists and musicians perceive and express the world differently, and how this can inform scenario thinking. He emphasizes that musicians don't always "plan" in a linear way, but rather feel patterns, improvise, and shift tones dynamically - much like planners must do when facing an uncertain future. Schwartz (1997) considers that "Music is a window onto freedom in the future."

Mason (2025) emphasizes that each scenario requires specific research, although there are subjects that need to be studied at all times: science, technology, and music.

In the conceptual paper on "futures thinking for transforming" Sohail Inayatullah (2008) integrates the concepts (disowned future, alternative futures, alignment, models of social change, and uses of the future), pillars (mapping, anticipating, timing, deepening, creating alternatives, and transforming) and questions. One of his concepts is about the alternative futures: why do we believe that there is only one future, and often cannot see the alternatives, but if we start looking for alternatives, we may see new ones. Inayatullah´s pillar, - past, present and future - are mapped: "By mapping time, we become clearer on where we have come from and where we are going" (Inayatullah, 2008). This principle of Past, Present and Future´s pillar is also applied here. This temporal distinction is not just chronological - it leads us to apply different analytical dimensions to our understanding of future-oriented thinking.

Futurology was first introduced by Ossip Flechteim in his 1966 book "History and Futurology", and it was introduced more like "historical sociology''' (Sardar, 2010). Other futurologists like Pentti Malaska summarized it as the question "What Does "Knowledge of the Future" Mean"? (Sardar, 2010). Contemporary young futurists, such as Kian Bakhtiari, a widely recognized figure featured in Forbes, contribute actively to current discourses in futurology, strategic foresight, and emerging cultural trends. In his article "7 Cultural Trends for 2025 and Beyond" (Bakhtiari, 2025), he identifies major transformations such as post-institutional decay, AI (Artificial Intelligence) empires, rising individualism, and postponed futures, particularly within the realms of culture and marketing. (Bakhtiari, 2025). However, while these contributions offer valuable insights into commercial and socio-cultural dynamics, they tend to overlook essential dimensions of long-term futures thinking - namely, the role of the arts (including music, storytelling, and cultural heritage) in shaping imaginative visions of the future. Bakhtiari's work also does not engage with the ethical legacies of science. These gaps highlight the need for more integrative foresight approaches - such as those grounded in STEAM and narrative-based methodologies - with historical reflection, and artistic engagement as well as cultural sustainability.

Bibri (2018) suggests inclusion of time-horizon, users, approaches in forecasting, and backcasting. Backcasting as a scholarly and planning approach is increasingly used in futures studies in the fields related to urban sustainability as an alternative to traditional planning approaches and a formal element of future strategic initiatives.

We summarise various relevant dimensions to see the differences in FFF in **Table 1**.

Table 1. Differences in Forecasting, Futurology and Foresight: Comparison

Dimension	Forecasting	Futurology	Foresight
Goal	Predict likely future outcome	Explore possibilities	Guide decisions
Time horizon	Short-to mid-term: 1-5 years	Long-term: 20+ years	Mid- to long-term: 5+/30
Approach	historical data, trend analysis.	Theoretical, exploratory	Strategic, applied
Certainty	Higher (for short term)	Low	Medium
Users	Analysts, planners, economists, Businesses, meteorologists	Academics, futurists, visionaries	Policymakers,organisations, consultants, NGOs

3. Definition of "Retrosight" for STEAM approach

In SMS, the concepts of FFF (indicated in **Table 1**) is approached in reverse - as an attempt to reframe FFF by looking from the perspective of the Present toward the Past in order to define the Future. This approach has been in use in practice since 2012 within the SMS framework, when SMS songs as a storytelling about different innovations of Scientists of the Past were first introduced (Kralj-Iglič, 2025). We can explore future scenarios via back-casting, or retrosight and historiography (based on research about scientists) - taking a reverse path due to the nature of the SMS method, which aligns with the STEAM approach. For instance, Bibri (2018) applies backcasting as a scholarly and planning approach is increasingly used in futures studies as an alternative to traditional planning and a formal element of future strategic initiatives. Thus, in the backward-oriented approaches: Backcasting, Historiography, Retrosight/or Hindsight, the term "Retrosight" best reflects our art-related method and can therefore be effectively integrated into a STEAM-based method. While Retrosight is occasionally used in foresight and innovation studies to refer to learning through retrospective analysis, we propose a definition grounded in the arts and education. In the context of STEAM and Futures Studies, we define the concept "Retrosight" as a method of STEAM learning that draws on retrospective analysis - using the arts and historical reflection to inform forward thinking. This concept aligns with the SMS method, which uses artistic tools such as storytelling, music composition, and visual interpretation to revisit scientific legacies. Through Retrosight, the SMS method connects past narratives with present-day learning and future-oriented thinking, highlighting how the arts can serve as a reflective and imaginative force in futures education. The **Table 2** includes the suggested Framework FFF in Reverse) which reflects the illustration of the SMS model (**Figure 1**) which can be used in future studies.

Table 2. A FFF Trilogy in Reverse: suggested framework

Concept	Future-oriented	Backward-oriented equivalent
Forecasting	Predicting likely futures based on current data	Backcasting / Historical Reconstruction - inferring past causes from present evidence
Futurology	Exploring possible futures in speculative/ philosophical ways	Counterfactual Historiography - exploring "what could have happened" in the past
Foresight	Strategically anticipating possible futures	Hindsight/Retrosight: using past patterns to inform present and forward thinking

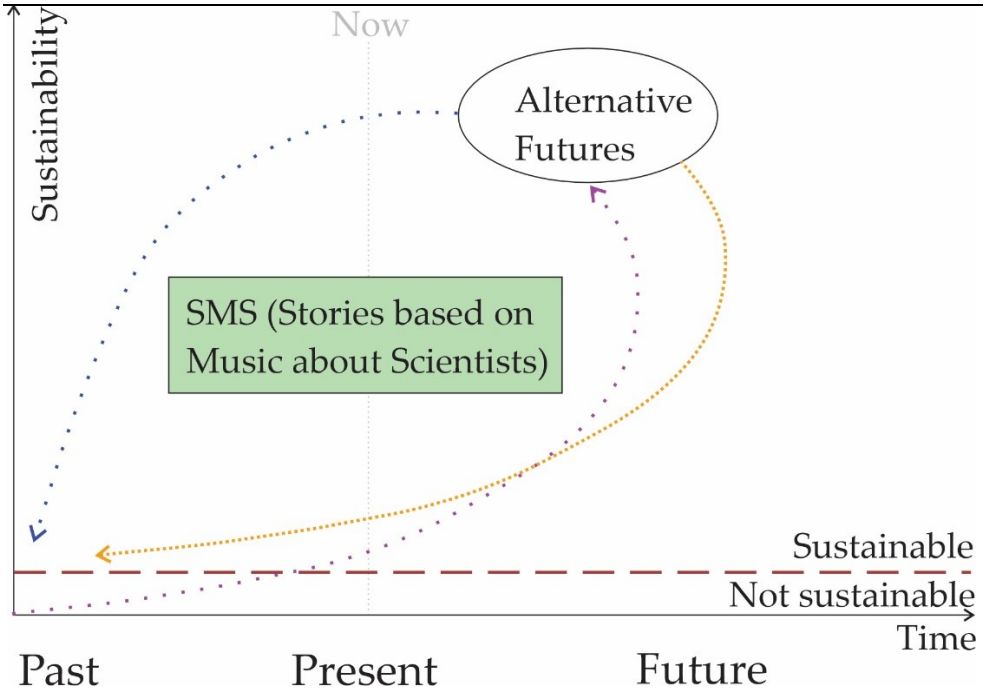

Figure 1. SMS model and Foresight with Alternative Futures. SMS is developed in Present (Now) to reflect the research about the idea of innovation of one of the scientists from Past time. This approach blends artistic expression with historical insight, offering a narrative bridge between past scientific thought and contemporary futures thinking. In life, no resource is 100% sustainable forever without careful management. Every resource- whether natural, human, or social—has limits. While physical resources degrade or exhaust over time, music, poetry, and art often endure across generations. They aren't consumed in the traditional sense, but rather transmitted, reinterpreted, and revived. SMS allows to approach from different angles of this FFF Triangle (Foresight-Futurology-Forecast). Therefore, we consider the SMS method a form of cultural sustainability.

Also, the SMS model can address the current and future uncertainties within the STEEP (Society, Technology, Economy, Environment, Politics) frame, as depicted in Terra Incognita (Goldin & Muggah, 2020) (**Figure 2**).

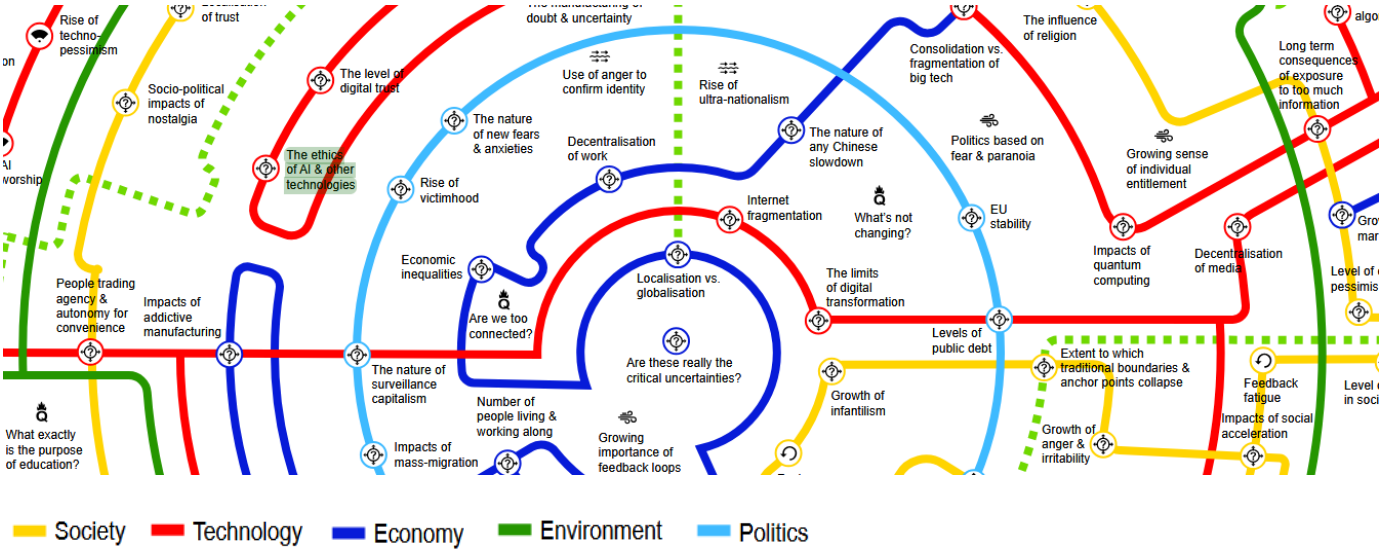

Figure 2. Mapping Uncertainties. A fragment. From (Goldin & Muggah, 2020).

4. Results

The results are a list of selected SMS songs, shown below. Each song includes three components: Music, Poem, and Image. All songs are freely shared. One SOS (Songs about Science) is included as an example of a preliminary version. It is close in form to SMS, but was not recorded in a studio and therefore does not include a video image.

SMS songs can be meaningfully connected to the "Map of Uncertainties" (**Figure 2**) by addressing key themes such as ethics, social responsibility, resource allocation, and the evolving role of science in society. Through creative storytelling, SMS offers a way to explore these uncertainties not just in contemporary contexts, but also through historical examples.

21th century:

1. "Where is my home" (in English): Reflection on migration by the modern scientists. https://www.youtube.com/watch?v=B4ZM3lzl1iU (This SMS introduces a composite image of a contemporary scientist in migration, inspired by the experiences of Jacob Bronowski, (1908–1974) – British-Polish mathematician, biologist, philosopher, and historian of science.

20th century:

2. "Crossing" (in English & Russian). Poem: Robert Oppenheimer (1904-1967), American physicist. https://www.youtube.com/watch?v=MOfArpU9OkI This version of SOS (Songs about Science) does not include an image (3rd component) for two reasons: It is performed live, without visual projection or professional studio editing. There is no budget for the professional studio production (therefore, digital artwork is absent).
3. "Spring is coming with water" (in Russian). Theory of Time: Nikolai Kozyrev (1908-1983), Soviet astrophysicist. https://www.youtube.com/watch?v=q5NC7Kc-UO8
4. "Star Selena" about Yuri Gagarin (1934-1968), Sergei Korolev (1906 – 1966), Konstantin Tsiolkovsky (1857 – 1935), Soviet astronauts and rocket scientists. https://www.youtube.com/watch?v=kyMi393_Y1I

19th century:

5. "You say I am a Riddle" (originally in English, translated into Russian by Aleona von Sultanova); Poem: Alfred Nobel (1833 - 1896), Swedish chemist, engineer, inventor, businessman, and philanthropist https://www.youtube.com/watch?v=vL0KI5Ow1Rg&list=RDvL0KI5Ow1Rg&start_radio=1
6. "Загадка«. (Riddle. Poem: Alfred Nobel (translated and performed in Russian with the different images): https://www.youtube.com/watch?v=6ZbaSAVtN1k
7. "Evening hymn": James Clerk Maxwell (1831-1879), Scottish physicist, mathematician and poet, https://www.youtube.com/watch?v=qyZIRCKG240

18th century:

8. "Morning Hymn" (Уже небесное светило) (in Russian). Morning Meditation or Ode to the Sun/Утреннее размышление или Ода Солнцу): Mikhail Lomonosov. https://www.youtube.com/watch?v=wysfY8a-YRM Poem: Mikhail Lomonosov (1711–1765), a Russian polymath (literature, education, chemistry, physics, mineralogy, history, art, philology)
9. "Road of a lifetime"or "Water" Johann Georg Gmelin (1709-1755), German naturalist and botanist. https://www.youtube.com/watch?v=daiSGLn-0GI
10. "Apples of Sievers" (in Russian) about Johann August Carl Sievers (1762–1795), a German-born botanist who explored Central Asia, Siberia, and other regions of the Russian Empire. Among the species described by Sievers is Malus sieversii, the ancestor of the domesticated apple. https://www.youtube.com/watch?v=i8Nw2nyPTmc

17th century:

11. "Baron Valvasor" (in Russian and Slovenian). Janez Vajkard Valvasor (1641 –1693), a natural historian and polymath from Carniola. https://www.youtube.com/watch?v=x7dsaxGGNLk

12. "Soul of Robot girl" or Romance about Alchemist (in Russian) about Jacob Bruce (1669 – 1735), scientist, inventor, diplomat statesman: https://www.facebook.com/1346167803/videos/pcb.10220238261770494/10220238242370009
13. "The world is a bubble". Poem: Francis Bacon (1561-1626), English philosopher, statesman, and scientist https://www.youtube.com/watch?v=c8v5-1S9S8k .

There are other SMS songs that were not recorded in a studio but performed live - some still include visual images during performance. These include:

"Love to Pigeon" (*Любовь к голубке*) — about Nikola Tesla (1856–1943), a Serbian-Croatian-American scientist; "Will You Come Along with Me" — based on the work of James Clerk Maxwell; "Glaube und Tat" — performed in German and Russian, with a poem by Immanuel Kant (1724–1804), a German philosopher and key figure of the Enlightenment in epistemology, metaphysics, and ethics; "The Chain of Connection" based on a poem by Alexander von Humboldt (1769–1859), a German polymath, translated into English by Bill Nuttle; "Galileo Galilej – Эти планеты", These Planets - about Galileo Galilei (in Russian); "Danish Erasmus" (*Датский Эразмус*) — about Erasmus Bartholin (1625 – 1698), a Danish physician and grammarian; "Poem on Medicine" — attributed to Avicenna (Ibn Sīnā) the renowned Persian philosopher and father of medicine (died 1037); "Omnis Mundi Creatura"- a medieval text by Alain de Lille (1125 – 1202), a French theologian and poet.

All SMSs sit at the intersection of various interdisciplinary and philosophical themes, and much broader than just one topic. According to STEEP, Alfred Nobel could be categorized into "Economy", yet the song reflects a much broader scope - particularly his philosophical outlook and inner conflicts. As with many SMS pieces, the subject transcends any single category, blending economic, ethical, environmental and existential as well as many other themes. Thus, SMS is more than just song writing - it is a narrative technique that integrates music and storytelling (story-singing) to humanize scientific futures and engage with the same questions we face today.

The role of science and education is central to this exploration based on the songs written on the lyrics of Francis Bacon (the 17th century´s English philosopher and statesman) that contain consideration of societal problems, and James Clerk Maxwell (the 19th century´s Scottish physicist and mathematician, famous for his theory of electromagnetism) that consider issues regarding environment.

17th-century scientists like Jacob Bruce, featured in "Soul of Robot Girl" (number 12), becomes a lens through which to examine the ethical dimensions of scientific ambition, now echoed in modern concerns about AI, ethics and emerging technologies (the Ethics of AI is highlighted in **Figure 2**, red line; Technology). Francis Bacon's philosophical vision in "The World is a Bubble" (number 13; pertains to the yellow line; Society in **Figure 2**) touches on uncertainties about knowledge, society, and the human condition, all central to today's debates on education, scientific authority, and values. By revisiting the lives and ideas of historical figures through SMS, we create a bridge between past and present uncertainties, showing that many of the questions we face today are deeply rooted in the scientific and philosophical legacies of earlier centuries.

The modern problems of migration are considered in "Where is my home?" (listed under number 1; light blue and dark blue lines in **Figure 2**) can be reflected based on Jacob Bronowski, British-Polish mathematician, biologist, philosopher, and historian of science (Edgerton, 2019). Bronowski is known for the influential BBC series "The Ascent of Man" (1973). May-Britt Moser - a Norwegian neuroscientist and Nobel Prize laureate in Physiology or Medicine (2014, with Edvard Moser and John O'Keefe) expressed that international collaboration and cultural openness are essential to science. She has emphasized the critical role of diverse collaboration and open scientific culture in advancing research: "We need all kinds of people doing science" - different people from different backgrounds bring different insights, highlighting the importance of inclusion and international teamwork (Danylova and Komisarenko, 2025).

SMS songs can be addressed to various topics outlined in the Map of Uncertainties - including ethical concerns, scientific responsibility, social impact, and the challenges of limited resources. They offer creative reflections on these themes through historical examples, making abstract uncertainties more tangible and relatable. Moreover, SMS songs go beyond the rational and pragmatic scope of the Map. These songs also capture the human, emotional, and existential dimensions of the scientific experience - feelings of wonder, doubt, loneliness, love, and inspiration. In this way, SMS provides a richer and more nuanced perspective, complementing analytical approaches with a poetic and deeply personal view of science and those who pursue it.

5. Discussion

The STEEP framework was introduced as a tool to explore current and future challenges. However, what is most significant is that many of the topics it includes have historical roots—issues that scientists in the past have already addressed or even solved. The goal of the SMS method is to spark new ideas, inspire innovation, and support more informed decision-making. This discussion demonstrates how creative methods like SMS can be applied in practice—through experiments that use artistic tools to map uncertainty and reframe our understanding of complex future challenges. The broader focus lies in the integration of STEAM approaches into futures thinking.

Mapping uncertainty becomes a pedagogical tool, helping learners connect emerging trends with historical patterns and cultural narratives. The SMS method provides a compelling example of how science and art can intersect to navigate the unknown. These songs offer a creative lens for exploring how scientists of the past were already engaging with questions that remain urgent today—such as education, citizenship, and planetary health. By giving musical form to their original poetic texts, the project invites us to revisit the past not as something fixed, but as a living dialogue - one that can inspire how we imagine and shape the future.

SMS aligns with the STEEP and supports the mapping of uncertainty in both present and future contexts. By applying Retrosight—a creative, backward-looking approach that begins with imagined futures and traces pathways back to the present—the method positions the Arts within STEAM as a strategic tool for futures-oriented learning and planning. Rather than viewing the past solely as history, Retrosight uses artistic expression to reinterpret past knowledge and experiences through the lens of future aspirations. As a management approach within the STEEP framework, it encourages broader reflection on how science, art, and education can work together to envision and co-create more inclusive and resilient futures. Inayatullah (2020) uses the term “walled past” as a metaphor for rigid institutional traditions, entrenched mindsets, and legacy structures that limit educational innovation. This "wall" prevents the emergence of transformative thinking by: 1. Reinforcing fixed schooling models (fixed ages, curriculum, standardized exams). 2. Maintaining conservative leadership responses—favoring continuity over creative alternatives. 3. Suppressing alternative futures in favor of the status quo, even when workshops initially generate bold visions.

In SMS, STEEP was used as a framework to illustrate how various scientists of the past time can reflect on contemporary challenges from different disciplinary perspectives. The SMS method offers a poetic and artistic response to STEP, inviting deeper reflection beyond conventional categories, where one field – Economy - is initially underrepresented, given the difficulty of addressing complex economic issues through song (although can be made in other styles, or to be re-directed towards Educational purpose). However, it still can be meaningfully reflected upon (in a broader sense). For example, an SMS composition on migration (primarily categorized under Politics, shown in light blue in **Figure 2**) can also be interpreted through an economic lens (dark blue in **Figure 2**), as migration is often driven by economic conditions. What matters is how these challenges were understood and addressed in the past - many of today’s issues, such as mass migration, have also historical precedents. SMS compositions reconnect with those past experiences, offering both emotional resonance and also insight. Additionally, these songs can be referenced in a way similar to destination branding, where music serves as a narrative tool to evoke place, memory, and identity.

6. Conclusions

The results of this work will most probably have profound consequences on the art practices of STEAM approach towards FFF, highlighting how each frames the anticipation of the future in different ways. Scientists might also try to introduce a reverse approach to future scenario-building, where alternative futures are not projected linearly but imagined creatively through art-based and STEAM-oriented practices. As recognized by the WHO (World Health Organisation) and the European Commission, Art is essential not only for health and homeostasis, but it serves as a key component of cultural sustainability.

The next step of this research is targeted toward the health or planetary health and sustainability issues with the cultural foresight dimensions. It may involve narrative foresight with arts-based methods, and cultural framing. The further research might be related to the very broad specter of topics: how various organisations and institutions respond to the art-related STEAM practices like SMS methods in different fields – in STEM disciplines, in Health and Medicine fields, in the area of Higher Education Management, Economics, and Finance, as well as Marketing and Branding (like Branding Cities or Branding Destinations). In addition, we can explore mapping uncertancies within a broader STEEP (Society, Technology, Economy, Environment, Politics) framework with Arts-related SMS method of STEAM. The contemporary and future challenges in social issues such as citizenship and migration (the migration issues were well present in the research of the 17-18-19 centuries due to migration of European population to USA, Africa and other continents) can be further explored. By reinterpreting uncertainty not as a limitation but as a creative space, the work suggests that science and education can prepare society for complex futures.

Funding: The authors acknowledge the financial support from the Slovenian Research Agency core founding No. P3-0388, and University of Ljubljana interdisciplinary preparative project Nanostructurome 802-12/2024-5.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Bakhtiari K. 7 Cultural Trends For 2025 And Beyond. Forbes 2025. Available at https://www.forbes.com/sites/kianbakhtiari/2025/05/25/7-cultural-trends-for-2025-and-beyond/. Accessed on 4.8.2025
2. Bibri SE. Backcasting in futures studies: a synthesized scholarly and planning approach to strategic smart sustainable city development. European Journal of Futures Research. 2018; 6:1-27. DOI:10.1186/s40309-018-0142-z
3. Danylova TV, Komisarenko SV. How the brain makes sense of the world: May-Britt Moser and the 2014 Nobel prize in Physiology or Medicine. Ukr.Biochem.J. 2025; Volume 97, Issue 3, May-Jun, pp. 109-116. doi: https://doi.org/10.15407/ubj97.03.109
4. Edgerton DEH. Bronowski J. The complex life of a science popularizer. Nature. 2019; 571: 7763. DOI: 10.1038/d41586-019-02010-y
5. Fidler D. Foresight defined as a component of Strategic Management. Futures. 2011; 43:540-544. DOI:10.1016/j.futures.2011.02.005
6. Goldin I, Muggah R. (2020). Terra incognita: 100 maps to survive the next 100 years. Random House. Available at: https://igarape.org.br/en/terra-incognita/. Terra Incognita, A map of current and future uncertainties. Available at: https://www.nowandnext.com/PDF/Terra%20Incognita%20%20a%20map%20of%20current%20and%20future%20uncertainties.pdf. Accessed on 2.8.2025
7. Inayatullah S. Six pillars: futures thinking for transforming. Foresight. 2008; 10:4-21. DOI:10.1108/14636680810855991
8. Inayatullah S. Co-creating educational futures: Contradictions between the emerging future and the walled past. Education Research and Foresight working papers.UNESCO Digital Library,2020. Available at https://unesdoc.unesco.org/ark:/48223/pf0000373581. Accessed on 4.8.2025
9. Istileulova Y. The Age of Enlightenment in the New Method of STEAM Approach: Apple-Tree of Johann Sievers (Germany, 1762–1795). *STEAM Conference Proceedings*,2023 Athens. Journal:The Age of Enlightenment in the New Method of STEAM Approach: Apple-Tree of Johann Sievers (Germany, 1762–1795)

10. Jantsch E. Technological forecasting in perspective. A Framework for Technological Forecasting, its Techniques and Organisation. 1967, Paris: OECD
11. Kralj-Iglič. Z-STEAM activities at the 13 th Socratic Lectures Symposium, Concert at the City Hall and Opera Coronation of Poppaea. Proceedings of Socratic Lectures. 2025, 13, 118-128. https://doi.org/10.55295/PSL.13.2025.14
12. Marien M. Futurs Studies and Policy Studies: Complementary Flelds in Pubic Affairs. RPR. 1984; 4: 5-42. https://doi.org/10.1111/j.1541-1338.1984.tb00158.x
13. Mason MK. Future scenarios: The art of storytelling.2025. Available at https://www.moyak.com/papers/scenarios-future-planning.html. Accessed on 4.8.2025
14. Meadows DH, Meadows DL, Randers J, Behrens WW. The Limits to Growth: A report for the Club of Rome's project on the predicament of mankind. Universe, New York 1972.
15. Miles I. The development of technology foresight: A review. Technological Forecasting and Social Change. 2010; 77:1448-1456. https://doi.org/10.1016/j.techfore.2010.07.016.
16. Sardar Z. The Namesake: Futures; futures studies; futurology; futuristic; foresight—What's in a name?. Futures. 2010; 42: 177-184. https://doi.org/10.1016/j.futures.2009.11.001.
17. Schwartz P. Art of the long view: planning for the future in an uncertain world. John Wiley & Sons. 1997
18. May-Britt Moser (2019). Nobel Prize in Physiology or Medicine. "We need all kinds of people doing science" https://www.youtube.com/watch?v=HL0s7vFYvIY