ISSN: 2278-3369

International Journal of Advances in Management and Economics
Available online at: www.managementjournal.info

RESEARCH ARTICLE

BACKCASTING METHODOLOGY TO ANALYZE EMERGING TECHNOLOGIES THROUGH LITERATURE REVIEW

Mallamaci Valentina[1,2*], Mavilia Roberto[2,3], Fotia Pasquale[3]

[1]*Department of Economics and Business, University of Catania, Italy.*

[2]*ICRIOS-The Invernizzi Centre for Research in Innovation, Organization, Strategy and Entrepreneurship - Bocconi University, Department of Management and Technology, Via Sarfatti, 25-20136, Milan, Italy.*

[3]*University for Foreigners "Dante Alighieri", Via del Torrione, 95-89125, Reggio Calabria, Italy.*

***Corresponding Author: Mallamaci Valentina**

Abstract: Companies and universities are investing in innovation and technology R&D. To avoid the risk of medium-long-term non-sustainability due to uncertain technology evolution, opportunity cost should be used to choose which technology to invest in. Systematic review and narrative literature analysis evaluate new technologies. Past-Facing and Future-Facing approaches help choose the optimum technology. The methodology has five steps: selection of databases and sources to be subjected to the tested analysis procedure; validation of the selected papers; transition to blinded mode to ensure impartiality; and establishment of the team of experts to apply the evaluation procedures of expert elicitation and quality assessment through SANRA and SCAST tests, which comprise the new experimental SANSER test. Systematic and narrative reviews are examined differently. The first is NR4CASTING, which identifies scientific papers to generate a collection validated by the procedures provided to compose the new narrative review. SR4CASTING classifies scientific papers to build a literature review with references from selected and assessed studies. Our narrative and systematic literature analysis and backcasting method maximizes future-focused decision-making. Thus, NR4CASTING and SR4CASTING allow us to advise the decision-maker on the optimum firm technological evolutions while minimizing switching costs and optimizing expertise and resources.

Keywords: *Backcasting, Literature review, Narrative review, Systematic review, Technological innovations.*

Article Received: 29 June 2024 **Revised: 24 Sept. 2024** **Accepted: 19 October 2024**

INTRODUCTION

Scientific research moves quickly, therefore systems to track and find patterns in scientific publications are needed. Due to their socio-economic effect, research and development, academic publishing, and policymakers have focused on emerging technologies. Conference planners must also understand current trends to find hot themes for calls for papers and hire reviewers who do.

New technologies' effects are unclear and their language and meaning are imprecise. This study predicts scientific subject growth. Recent documents are unreliable and cannot be used instantly, making citation analysis tools unsuitable for studying emerging trends. Citation analysis requires widely circulating materials.

Relevant literature should start all research. To support the study's purpose and hypotheses, the author maps and assesses the research area. To ensure accuracy, precision, and credibility, any investigation must be thorough. The researcher can employ different literature review methods, standards, and guidelines depending on the aim.

Next section covers literature review concepts and past/future approaches progression. Section 3 covers analysis methods. Section 4 discusses our procedural results. Section 5 discusses study limitations and possible developments. Section 6 concludes the paper.

Theoretical Background

Literature Review as Research Methodology

Systematic reviews may answer research questions, summarize issues and assesse topic knowledge, as set research goals, find gaps, and discuss a topic. (Tranfield *et. al.,* 2003). Systematic reviews can also analyze data from an alternate present to a variety of plausible bifurcation sites and routes and findings from an alternative present. In these cases, a systematic review could create a new theoretical model and track a study problem.

We can determine if an effect is consistent and if more research is needed. Techniques can also reveal which study-level or sample characteristics affect the issue, such as whether research in one sociocultural environment gives statistically diverse results from those in others (Davis et al., 2014).

A publishable review requires multiple steps and decisions (for specific considerations in respect to each phase).

- Audience interest determines review topic. Thus, it's best to scan the topic first to evaluate previous literature reviews, estimate the number of research papers to be evaluated, and define the review's objective, scope, and study issue. After choosing the study question and general review technique, create a literature search plan.
- Review the aim, research questions, and procedure. Pre-evaluate search phrases and inclusion criteria. Evaluation type and scope determine sample selection.
- Analyzing the review: after systematic review and sample selection, article evaluation is crucial. Select a sample and consistently extract important information from each article. The review's purpose and topic determine this.
- Justify the assessment first. The technique may require varied facts and depth in the review piece. Systematic literature reviews use PRISMA, narrative reviews RAMSES, and integrative reviews Torraco (2005).

guidelines cover literature review reporting and structure. Discussing review progress and literature collection is crucial.

Authors must describe how they found, studied, and created literature.

Most empirical research articles, grant proposals, and book chapters review relevant literature using narrative reviews which provide a conceptual overview of the subject. Narrative reviews offer an expert's perspective, lessen information overload, and highlight significant facts and challenges, according to Sarkar and Bhatia (2021). These accessible reviews highlight favorable discoveries. Literature reviews help when evidence is scant, fragmented, or issue objectives are unclear. So, experts can assess the evidence and point out flaws and clarifies results.

This publication uses simple collation (handout of selected research papers) and structured synthesis for narrative reviews. First, decide what questions the review will address, the criteria for the literature search, and the flexibility in choosing databases, search terms and combinations, identification criteria and thresholds, information extraction procedures, and data synthesis and implication methods.

Instead of summarizing literary findings, authors should highlight themes and compare and contrast. A trusted expert could review the manuscript. In-house evaluation and improvement may benefit. Therefore, the process may lead to the following outcomes: a structured representation of the chosen articles and a simple collection of the chosen articles.

Past-Facing and Future-Facing Approaches

Long-term planning requires a dependable way to predict and change future events.

Operational environment dynamics and technology-induced changes-which are interrelated-present the biggest opportunities and threats to the organization's survival in both cases. Thus, a well-calibrated organization must be imagined. Today's choices will last. Big decisions should regard the future and visionary states need future scenarios.

Forecasting optimizes organizational and labor policy. A forewarned plan permits proactive response to near-to medium-term opportunities and risks.
Forecasting helps companies stay ahead by managing risk and it can somewhat enable this, however validation and replication methods are becoming insufficient to validate forecasts in the near future. This contributed to the creation of the backcasting process (Dortmans, 2004).

Bendor *et. al.* (2021) assess several ways and depict the future of landscape as a two-dimensional interaction of activity concentration on goals or paths and stakes.

Future data-the building blocks of the future-comes from the past, making their task cliche. Few futuring procedures explicitly engage the past, but all do. Forecasting, backcasting, recasting, and pastcasting are foresight methods that shape futuring. Recasting imagines a new present, while forecasting predicts the future. Backcasting explores future possibilities to discover paths from the present to a preferred future, while pastcasting starts with a favored present and examines how past possibilities could have led to that present (see Fig. 1).

These four futuring methodologies can examine the activity's results and stakes. Backcasting and pastcasting, the current study's symmetries, appear to be convergent and suited for examining numerous routes to a desirable future or present, pluralizing past and current stakeholders' voices.

Past and future methods have different stakes; prediction is riskier than recasting. The past is less changeable than the future, making it harder to modify. So, while backcasting can help futures researchers and practitioners gain a better understanding of future change levers, pastcasting can help them uncover the conditions, assumptions, barriers, and opportunities that influenced the I realization of past-futures, thereby informing, inspiring, and preparing future-facing actions (Bendor *et. al.,* 2021).

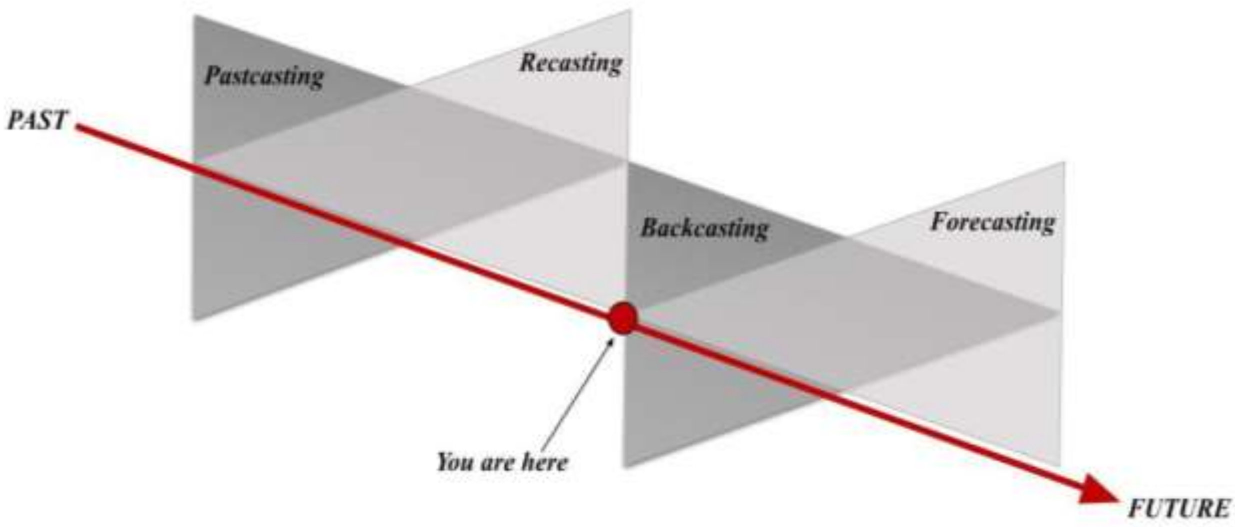

Figure 1: Schematic representation of past-facing and future-facing approaches (Bendor *et. al.,* 2021)

Forecasting: a typical forecast begins with a (near) current state and projects to a future state, which typically refers to land-use changes that may occur during a specific time period. All futuring tactics that aim to "systematically explore the possibilities that lie ahead" use forecasting as an example (Whiston, 1979). Forecasting multiplies a predicted future into several feasible options. Forecasting has lost its promise of scientific impartiality due to ideological, organizational, methodological, and human biases after its popularity after the Second World War (Cole, 1979; Whiston, 1979 In addition to this, there is a growing realization that forecasting influences not only the present, but also the very futures that it aims to unfold (Mallard & Lakoff, 2011; van Lente, 2012). Forecasting helps us see the future as a growing set of options to explore, assess, and navigate, guiding technological and policy innovation.

Recasting: it refers, in its most fundamental sense, to the process of reconstructing the present. It makes use of methodologies for forecasting that begin with a condition that was established in the past and projects to the current state, typically for the purpose of comparison (from a projected current state to the actual state). This kind of analysis is helpful for calibrating instruments and acquiring a comprehension of a condition that was unknown in the past but has become apparent in the current state.

Recasting, unlike anticipating, finds "tracks not taken" that could have changed the present. It involves testing simulation models using historical datasets, interpreting their output in light of real events, and publishing the results. The use of recasting in some form has already been put to use by futurists in order to improve upon previously conducted exercises geared toward the future, but it has also been put to use in order to model and decrease risk (Woo et al., 2017; Woo, 2019). Recasting lets futuring activities explore hypothetical histories that (did not but could have) taken place to motivate them.

Second Symmetry: Backcasting and Pastcasting

Backcasting: The backwards version of forecasting, in which the model begins from some point in the future and then plots a course of development leading up to the present status quo. It shows the range of possible development paths to an ideal future, while forecasting highlights probable or conceivable futures. “Generating a desirable future and then traveling backwards from that future to the present to strategy and plan how to reach it” (Vergragt & Quist, 2011).

Whereas forecasting attempts to pluralize the future, backcasting tries to pluralize paths to the future. As a result, where forecasting appears to be divergent, backcasting appears to be convergent, giving the cone representing it its distinctive shape and orientation.Then, it is possible to define backcasting as the process of imagining a favorable future and then working backwards from that future to the present in order to formulate a strategy and arrange a plan for how it might be attained.

Backcasting emphasizes preferred futures over plausible ones. Since it "travels backwards" from a future end-point to the present to judge what measures are needed, it is explicitly evaluative. Backcasting boosts forecasting credibility (otherwise, it remains only fantasy or creative speculation). (Robinson, 1982). *Pastcasting:* This study begins with a present time point (often a virtual, improved "now") and traces a developmental path backward. Pastcasting creates fictional paths. Each path represents a non-factual historical bifurcation that could have transformed the present. Pastcasting, unlike forecasting and recasting, works backwards from a chosen alternative present to various bifurcation points and trajectories.

Pastcasting, like recasting, enables planners compare projected and actual spatial planning outcomes. Pastcasting evaluates implementation, while recasting compares model predictions and results: “We journey from what planners envisioned for a present scenario to earlier time points to determine where the developmental pattern strayed from the planned path” (Deal *et. al.,* 2017). They found that pastcasting and recasting can assist planners and communities avoid mistakes. Reevaluating old goals can also help rank new tactics.

Backcasting is commonly used to forecast complicated long-term challenges encompassing many facets of society as well as technical advancements and developments. The focus of attention is on a perceived major social issue, such as technological advancement.

The following characteristics favor backcasting:

When the problem to be studied is complex, affecting many sectors and levels of society;

When there is a need for major change, i.e. when marginal changes within the existing order will not suffice;

When dominant trends are part of the problem-these trends are often the cornerstones of forecasts;

When the problem is largely a matter of externalities, which the market cannot control.

As a result, the goal of the backcasting approach is to broaden perspectives of potential solutions among diverse players and to emphasize the societal effects of strategic choices (the opening or closing of future options).

From a purely business point of view, backcasting allows companies to contain switching costs related to technological transitions and to maximize existing knowledge advantages and benefits by using all resources already integrated into companies (Dreborg, 1996).

Finally, Sandford (2019) distinguishes between the "instrumental future" which explores present untapped and abstract desires and the "lived future" which relies on society's imagination future and social interactions' material and emotive features. This last picture of the future is most like the backcasting approach we intend to use in this research, and Sandford suggests it to develop future research that aims to have a positive social impact by engaging with the past through linked interests and values. To keep their earlier experiences relevant, future academics interested in understanding and developing care-related futures and context-specific interests should interact with these.

METHODOLOGICAL PROCEDURES

Search Strategies

The specific question here is how to optimize literature search methods to maximize the trustworthiness (i.e. validity) of knowledge-building and theory-generating qualitative systematic reviews.

Before performing a knowledge-building or theory-generating qualitative systematic review, consider qualitative research in general. Thus, qualitative findings based on research subjects' ideas and experiences are the purpose. Qualitative systematic reviewers select a topic and associated research to support and justify a review. To facilitate analysis, interpretation, and synthesis across studies, there must be enough topic-specific and contextually rich qualitative research reports. Qualitative systematic reviews for knowledge-building or theory-generation appear to have two major dependability hazards. The first is a complex collection of study reports without well-defined research goals and subjects. In this scenario, the sample should be refined to match the research topic and questions. The second difficulty is a lack of descriptively rich studies to yield saturated findings.

Theory-building systematic reviewers explore the literature extensively to avoid having too few descriptive qualitative rich research. Expansive searches are used to separate knowledge-building and theory-generating qualitative systematic reviews from summative and aggregative qualitative systematic reviews (e.g. meta aggregation) (Booth, 2006; Hannes & Lockwood, 2011). Searching the literature requires regular monitoring and recalibration.

Bates (1989; 2007) outlined a comprehensive literature search method. Key search concepts and basic research reports arise as research inquiries become more logical. Instead, it is a convoluted issue-solving process that alternates inductive and deductive reasoning, synchronous searching, selecting, and dismissing, and problem formulation, refining, and confirmation (Bates, 1989, 2007; Barroso et al., 200; Hider, 2006; Johnson, 2009; Boell & Cecez-Kecmanovic, 2010; Hannes & Lockwood, 2011).

Searching the literature and creating an impartial database are difficult. Qualitative and quantitative systematic reviewers must decrease different biases due to publication methods (Wilson, 2009; Finfgeld-Connett, 2010). Quantitative researchers seek statistical significance. If not, their findings may not be published in prestigious and publicly accessible journals.

Wilson (2009), Booth (2010), Song et al. (2010), and others found that positive quantitative findings are easier to obtain for systematic review than negative ones. Qualitative researchers focus on context as well as efficacy. Due to this shift, qualitative findings are no longer seen as good or bad, non-significant findings are no longer penalized, and publication biases are avoided (Finfgeld-Connett, 2010).

Experts have studied the best ways to find qualitative research papers in electronic databases. These findings imply that simple search methods may be as effective as more advanced ones for finding qualitative research reports. (Grant, 2004).

These optimal search methods are pre-built in CINAHL, EMBASE, and MEDLINE databases.

Methodologically, "the more the better" doesn't necessarily apply to qualitative systematic reviews for knowledge and theory construction. In qualitative research, validity (trustworthiness) is not just based on redundancy (Finfgeld-Connett, 2010), and extending a literature search has little significance unless it contributes to the sample in the context of the review (Booth, 2010).

Aggregative and summative systematic reviews seek more information. Thus, they are more quantitative than qualitative (Hannes & Lockwood, 2011). Since it is impossible to know what information has not been collected, stopping the literature search is a judgment call in any systematic review (Barroso *et. al.,* 2003, Booth, 2006). However, each assessment should carefully consider and support stopping looking (Booth, 2010).

When deciding to halt a literature search, consider that no systematic review will last forever (Yoshii *et. al.,* 2009) and that "lack of confidence must be seen as the primary source of information" (Sturmberg, 2011).

Boell and Cecez-Kecmanovic (2010) said more studies will be done, and their results will need to be compared to what is already known. Multiple systematic reviews on the same issue are also likely. Scholars will have to consider the value of a systematic review of systematic reviews.

Content Validity and Reliability

Replication is essential for accepting new theories and data in science. Empirical research requires repeating "experiments" to ensure that their results are similar and measure the same phenomenon. Repetition is key to the process, but not every time. even a perfect repetition will recreate some aspects of the initial investigation rather than only restating the findings of the study. The final product will be similar to the source material but not identical. If all study data are available, the results are validated following the procedure indicated in the research article. The authors and their databases can make quantitative research data available. In qualitative research, authors' data (such as surveys) must be utilised.

If the original data are missing, the evaluation was carried out based on the impact factor of the journal in the reference sector. When the study article's journal is in the Thomson Reuter's Journal Citation Report's Q1, Q2, or Q3, the results are regarded legitimate (JCR).

Blind Bias

To remove biases and protect scientific publication, a considerable submission revision is needed. Scientists should be judged on their papers, not their reputations or institutional status. People may subconsciously or purposefully support or oppose an article based on the author's name, gender, country, or institution. Similar to this, an article may be dismissed after first screening without further examination if the editor has a predetermined impression about the author's name, gender, past work, nation, or affiliated institution, regardless of its quality.

Well-known scientists at "prestigious institutions" or in wealthy nations have a much higher chance of having their papers published at the same level of substance. Thus, blind submission (submission without author identify and contact information) would reduce biases in manuscript rejection at editorial levels at the initial assessment stage. Anonymous articles can be appraised on their merit and content without personal or corporate bias. Blind submission and peer review promote scientific rigor and objectivity.

The blind review system improved publication evaluation impartiality (Kmietowicz, 2008). Blind submission acts as a "buffer" to remove subjective factors from first assessment level rejection decisions, but it does not guard against high rejection rates. So, a blind submission process allows editors to reject a large percentage of submitted papers more objectively and impartially.

Expert Elicitation

Expert judgment quantifies knowledge of a variable. The method asks each expert to produce a subjective probability distribution for the amount of interest to synthesize these distributions and provide information regarding uncertainty, causes of uncertainty, agreement/disagreement, and reasons for disagreement among the group of experts consulted.

The method is used when normal statistical methods fail and the quantity of interest is critical to policy decisions. This often occurs when the issue is extrapolating or generalizing data from one environment to another rather than internal validity. The technique assumes that professionals know this information, and by utilizing established protocols to elicit it, one may characterize the current state of knowledge, quantify uncertainty, and identify the primary sources of uncertainty in the quantity of interest.

Analysts use different methods to elicit expert judgment, but they all involve framing the question, reviewing the evidence, identifying and recruiting experts, developing an elicitation protocol, informing experts about well-known biases in human judgment, eliciting judgments, and analyzing, summarizing, and presenting the results.

After selecting, contacting, and consenting subject matter experts, the team creates the elicitation procedure. The training also informs specialists about human judgment biases like availability, anchoring, overconfidence, and how to reduce them in the elicitations. The session also allows professionals to freely discuss evidence interpretation issues and share recent knowledge about the topic.

After finalizing the technique, the project begins elicitation. Elicitations involve one-on-one interviews at each expert's office by the project team. After the expert provides his estimates, it is common to ask them to pretend they were gone from the issue for a while and discover that the true figure was slightly higher (lower). Elicitation then usually moves from extremes to the distribution's center. During the elicitation process, experts are shown their results, asked if they reflect their perspectives, and given the chance to correct any obvious errors or discrepancies.

Results reporting hinges on whether and how to incorporate expert viewpoints. No matter how the results are combined, any summary must begin with each expert's probability distribution. Each expert's rationale must be meticulously documented. If experts disagree, how to incorporate them becomes a challenge. Equal, peer, and performance weighting have been recommended. Cooke's "classical" method uses each expert's calibration question performance to construct weights for information (accuracy) and calibration (precision). Experts vary in subject topic expertise and probability data encoding.

Understanding probability distributions requires these abilities. Morgan says giving the decision maker the whole collection of individual findings is sufficient because formal results combining when experts disagree is not beneficial. The multimodal character of scientific articles makes it difficult to aggregate data in simple indexes that stakeholders may use to compare technology based on their preferences.

Research Quality Assessment (RQA)

The aforementioned technique is simple and concise enough for regular use and can help editors pick and revise papers, reviewers and readers evaluate paper quality, and authors write narrative reviews. Our study may also provide the finest understanding of possible developmental trajectories toward a desirable future.

The current study employed the SANRA approach as argued in Baethge et al. (2019) with data from a field test analyzing its practicability, item-total correlation, internal consistency, reliability, and criterion validity. The scale's authors revised SANRA in 2014 to simplify and improve dependability. The new scale's six components have numeric values between 0 (low standard) and 2 (high standard), with 1 signifying a middle ground. The highest possible total is 12.

The SANRA scale's overall score quantifies "quality of a narrative review article," which includes the following sub-constructs: (1) an explanation of the review's significance; (2) a statement of its aims; (3) a description of the literature search; (4) citation of relevant sources; (5) solid scientific reasoning; and (6) relevant and appropriate endpoint data.

Appendix provides anchor descriptions and examples for each instrument item to help users fill it out correctly. Finally, we created SANSER, Scale for the Assessment of Narrative and SystEmatic Review, which combines SANRA score and the expert elicitation score (SCAST - Scenario CASTing) to obtain a unique value, from 0 to 12, that defines the quality assessment of the analyzed review, considering future scenarios related to emerging, frontiering or dominant technologies. A panel of experts appointed by forecast scenario stakeholders determines this value. As seen in Fig. 2, the maximum cumulative SANSER score is 24.

Scale for the Assessment of Narrative and Systematic Review (SANSER)

Please, in this first section, rate the quality of the narrative and systematic review article in question, using categories 0-2 for each of the following six aspects. So the first total score can be max 12.

	QUALITY ITEMS (SANRA)	*SCORE (0-2)*
1.	*Justification of the article's importance for the readership*	
2.	*Statement of concrete aims or formulation of questions*	
3.	*Description of the literature search*	
4.	*Referencing*	
5.	*Scientific reasoning*	
6.	*Appropriate presentation of data*	
	TOTAL SANRA SCORE	*... / 12*

Please, in this second section, rate the quality assessment of the analyzed review, considering future scenarios related to emerging, frontiering or dominant technologies, using a 0-12 scale.

	SCAST	*SCORE (0-12)*
7.	*Expert Elicitation on future scenarios*	

TOTAL SCORE (SANSER = SANRA + SCAST)	*...... / 24*

Figure 2: SANSER scale

RESULTS

Based on the methodology and reference classification of the reviews presented in the background paragraph, we proceed with presenting the innovative techniques developped to analyze narrative and systematic reviews to acquire an evaluation and scientific classification of the same.

NR4CASTING

NR4CASTING classifies narrative review scientific papers by their characteristics.

Thus, we consider N publications (P_1, P_2, P_3,... P_n) identified utilizing databases and the search strategies in paragraph 3. Each study must first be validated by duplicating the experiments and checking the results. Papers that pass this verification will be called V_1, V_3, V_6,... V_n, rejecting the unsatisfactory ones. Next, we blind and rename each selected paper (B_1, B_2, B_3,... B_n) to ensure the impartiality of the team of experts who will evaluate the validated articles.

The team of experts, selected based on the breadth of the research and their documented expertise, will first apply the SANRA technique, assigning a score between 0 and 2 to each of the six evaluation criteria for a maximum total score of 12 points. After that, the same team of experts will perform the Expert Elicitation procedure (SCAST – 12 max score) to assign a score based on the probability that the technology described in the analyzed paper is emerging, frontier, or dominant in future scenarios, then readapting the second of the previously exposed time symmetries, Backcasting-Pastcasting.

The new SANSER approach (maximum 24 points) ranks papers by adding SANRA and SCAST ratings. Finally, each of these papers will be contained in the narrative review which is the final result of the NR4CASTING procedure.The following Fig. 3 depicts a technique application: P_1, P_2, P_3, and P_4 are first-validation papers. V2 fails this stage, thus we rename and renumber the blinded papers B_1, B_2, and B_3. The panel of experts then performs SANSER (SANRA + SCAST) tests. B_2 fails the expert assessment because it scores below the minimum. Only B_1 and B_3 pass the narrative examination.

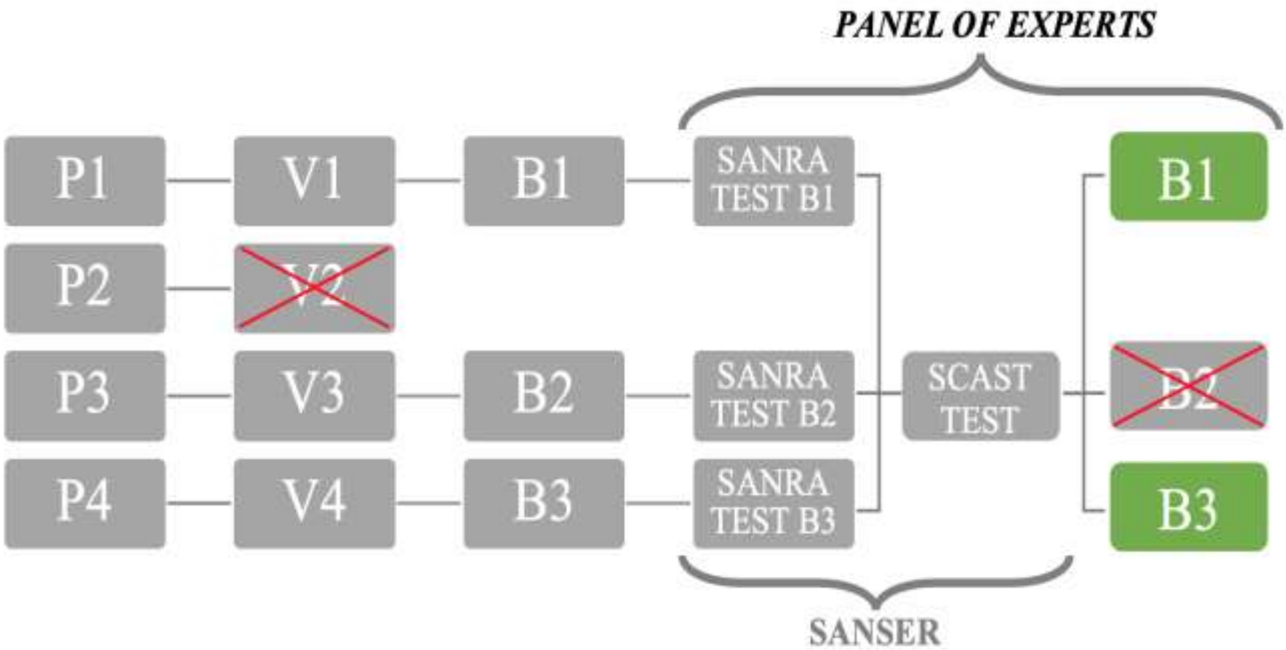

Figure 3: Schematic representation of NR4CASTING approach

SR4CASTING

SR4CASTING classifies systematic review scientific publications based on their features. As in the preceding scenario, N papers (P_1, P_2, P_3,... P_n) are identified utilizing databases and the search strategies in paragraph 3.Each publication is validated by recreating the illustrated experiments and validating the results. Papers that pass this verification will be called V_1, V_3, V_6,... V_n, rejecting the unsatisfactory ones.

The blinded version is not needed for these papers because they are based on citations from the literature and removing any reference will fundamentally change the text. The approved papers are subsequently submitted to the team of experts' SANRA and SCAST methods to acquire the final general score required by our SANSER approach.

The SR4CASTING procedure's final outcome is not the collection of all articles selected and suitably categorised as in the previous example, but a single literature review comprising references to all papers that passed selection and evaluation processes. The following Fig. 4 illustrates this procedure: P_1, P_2, P_3, and P_4 are first-validation papers. V_2 fails this stage, hence there is no need to rename and renumber the papers because the blinded mode does not apply. Thus, the expert panel performs SANSER (SANRA + SCAST) tests. V_3 fails the expert assessment. Only V_1 and V_4 make the final literature review.

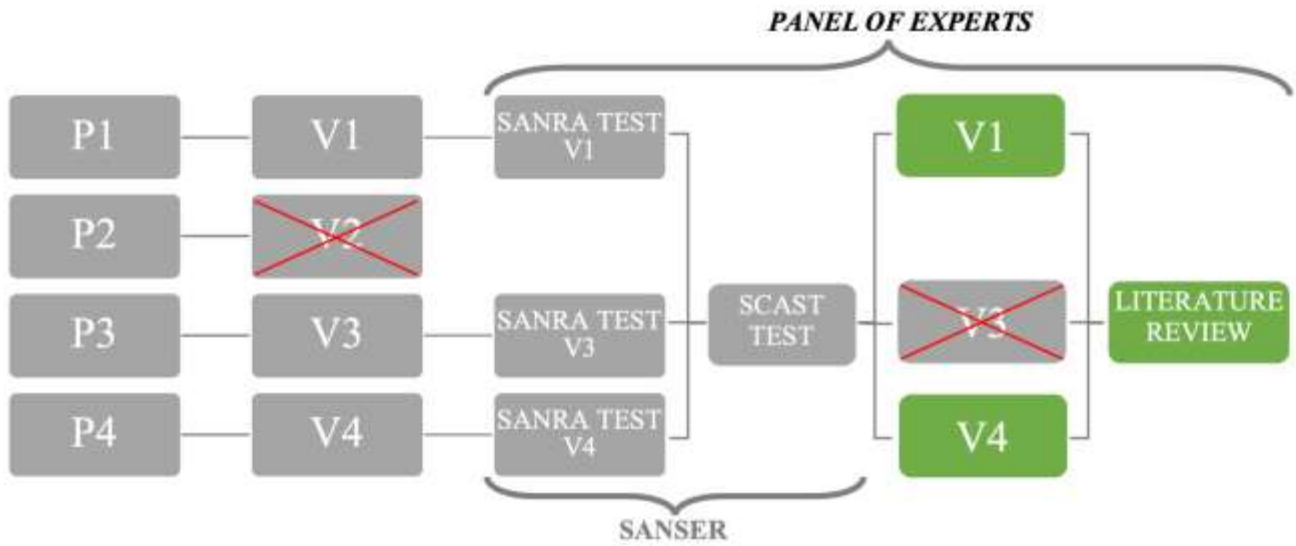

Figure 4: Schematic representation of SR4CASTING approach

Discussion: Limitations and Future Developments

This study describes technology detection research. We understand that technical advancement is not limited to current research activities. However, this method can be combined with others, such as bibliometric data on research activity (Bildosola, 2017). To assure accuracy, the prior chapter's methods might be executed utilizing blockchain. Making the system secure, verifiable and transparent supports its evolution. Machine learning could help set up a decision support system platform to construct different evaluation scenarios.

Blockchain-based solutions, along with big data and AI, are said to offer several potential answers, especially in terms of anticipation and foresight. Futuring and foresight may be valuable to blockchain systems because decision-making and regulation should be based on current knowledge and projections about future changes.

They are still evolving in response to global trends like socio-environmental change and new applications for the technology are being explored worldwide. Technology as a whole has a lot of potential, especially in community initiatives to make improvement, thus adopting blockchain is more than just a way to reflect on and demand changes.

Blockchain will also be part of a multi-system architecture with complex relationships. In an age of artificial intelligence, distributed ledger technology, and cyber-physical systems, the future of "thinking" will require our attention. (Schulz, 2020) The aforementioned strategy must be established by standardizing each stage. The research's authors' anonymity, the journal of publishing, bibliometrics, the panel of experts, and their non-repudiation-linked judgment are among these standard criteria. This study will expand on these research topics.

CONCLUSIONS

This research uses literature review (narrative and systematic) and a future-facing methodology to improve backcasting and decision-making processes for a realistic future. If you can anticipate critical decisions, you can better inform decision-makers on the optimal course of action, especially regarding technological innovation opportunities, to restrict costs and optimize the use of all resources, material, immaterial, and human, during such a shift.

As indicated in the introduction, this study provides two techniques that evaluate several specific purposes. Its main goal was to collect important scientific articles concerning emerging technology to validate scientific results. An expert panel then assessed that data (NR) to identify and resume (SR) emerging and dominating technologies without bias (using expert survey's SANRA and elicitation SCAST on the content).

Backcasting opens up decision-making processes to a wide range of stakeholders, democratizing policymaking, while pastcasting, although more elusive than the other three approaches, appears useful for unraveling past decision-making processes and revealing the biases that undermined and declined past possibilities and hopes.

Thus, two procedures-NR4CASTING and SR4CASTING-were created to evaluate and classify the narrative and systematic reviews. The new SANSER technique uses SANRA test scores and expert elicitation (SCAST) to rank the technologies explored by each procedure's researchers in order of achievability.

Finally, we encourage academics to use these methodologies to detect emerging and/or dominant new technologies because they give the futures strategic planning environment the vision, agility, and transparency needed to seize opportunities.

AKNOWLEDGMENTS

The authors express their gratitude for the comments received at the 32nd IAMOT Conference in Porto Alegre, Brazil (2023), which proved invaluable in refining the final version of this paper. Furthermore, the authors extend their appreciation to the enterprises affiliated with the University for Foreigners "Dante Alighieri" of Reggio Calabria, which tested the forecasting methodology. This experimental phase was instrumental in assessing the effectiveness and scientific rigor of the proposed approach.

REFERENCES

1. Andersson, J. (2018), The future of the world: Futurology, futurists, and the struggle for the post cold war imagination. Oxford: Oxford University Press.

2. Baethge, C., Goldbeck-Wood, S. & Mertens, S. (2019), “SANRA-a scale for the quality assessment of narrative review articles”, Research Integrity and Peer Review, Vol. 4 No.1, pp. 1-7.

3. Barroso J., Gollop C.J., Sandelowski M., Meynell J., Pearce P.F. & Collins L.J. (2003), “The challenges of searching for and retrieving qualitative studies”, Western Journal of Nursing Research, Vol. 25, pp.153-178.

4. Bates M.J. (1989), “The design of browsing and berrypicking techniques for the online search interface”, Online Review, Vol. 13, pp.407-424.

5. Bates M.J. (2007), “What is browsing-really? A model drawing from behavioural science research”, Information Research: An International Electronic Journal, Vol. 12 No. 4, pp. 330.

6. Bendor, R., Eriksson, E. & Pargman, D. (2021), “Looking backward to the future: On past-facing approaches to futuring. Futures, Vol. 125, pp. 102666.

7. Bildosola, I., Gonzalez, P. and Moral, P. (2017), “An approach for modelling and forecasting research activity related to an emerging technology”, Scientometrics, Vol. 112 No.1, pp. 557-572.

8. Boell S.K. & Cecez-Kecmanovic D. (2010), “Literature reviews and the hermeneutic circle”, Australian Academic & Research Libraries, Vol. 41, pp.129-144.

9. Booth A. (2006), “The number needed to retrieve: a practically useful measure of information retrieval?”, Health Information and Libraries Journal, Vol. 23, pp. 229-232.

10. Booth A. (2010), “How much searching is enough? Comprehensive versus optimal retrieval for technology assessments”, International Journal of Technology Assessment in Health Care Vol. 26, pp. 431-435.

11. Booth, A. (2006), “The number needed to retrieve: A practically useful measure of information retrieval?”, Health Information and Libraries Journal, Vol. 23, pp. 229-232.

12. Cole, S. (1979), Interests, hopes and fears-Can we change the future? In T. Whiston (Ed.), The uses and abuses of forecasting (pp. 323-343). Sussex, UK: Science Policy Research Unit, Sussex University.

13. Davis, J., Mengersen, K., Bennett, S. & Mazerolle, L. (2014), “Viewing systematic reviews and meta-analysis in social research through different lenses”, Springer Plus, Vol. 3, pp.511.

14. Deal, B., Pan, H., Timm, S. & Pallathucheril, V. (2017), “The role of multidirectional temporal analysis in scenario planning exercises and planning support systems”, Computers,

Environment and Urban Systems, Vol. 64, pp.91-102.

15. Doos, L., Packer, C., Ward, D., Simpson, S. & Stevens, A. (2016), "Past speculations of the future: a review of the methods used for forecasting emerging health technologies", BMJ Open, Vol. 6 No.3, pp.e010479.

16. Dortmans, P. J. (2005), "Forecasting, backcasting, migration landscapes and strategic planning maps", Futures, Vol. 37 No. 4, pp. 273-285.

17. Dreborg, K. H. (1996), "Essence of backcasting", Futures, Vol. 28 No. 9, pp.813-828.

18. Drost, E. A. (2011), "Validity and reliability in social science research", Education Research and perspectives, Vol. 38 No.1, pp. 105-123.

19. Evans, J. (2013), "Introduction to structured expert elicitation: A risk analysis perspective", Methods for Research Synthesis: A Cross-Disciplinary Approach.

20. Finfgeld-Connett D. (2010), "Generalizability and transferability of meta-synthesis research findings", Journal of Advanced Nursing Vol. 66, pp.246-254.

21. Finfgeld-Connett, D. & Johnson, E. D. (2013), "Literature search strategies for conducting knowledge-building and theory-generating qualitative systematic reviews", Journal of Advanced Nursing, Vol. 69 No.1, pp.194-204.

22. Golafshani, N. (2003), Understanding reliability and validity in qualitative research. The qualitative report, Vol. 8 No.4, pp.597-607.

23. Grant M.J. (2004), "How does your searching grow? A survey of search preferences and the use of optimal search strategies in the identification of qualitative research", Health Information and Libraries Journal, Vol. 21, pp. 21-32.

24. Hannes K. & Lockwood C. (2011), "Pragmatism as the philosophical foundation for the Joanna Briggs meta-aggregative approach to qualitative evidence synthesis", Journal of Advanced Nursing, Vol. 67, pp. 1632-1642.

25. Hider P. (2006), "Search goal revision in models of information retrieval", Journal of Information Science, Vol. 32, pp. 352-361.

26. Johnson J.D. (2009), "An impressionistic mapping of information behavior with special attention to contexts, rationality and ignorance", Information Processing and Management Vol. 45, pp. 593-604.

27. Kmietowicz, Z. (2008), "Double blind peer reviews are fairer and more objective, say academics", British Medical Journal, Vol. 336 No. 7638, p.241.

28. Mallard, G. & Lakoff, A. (2011), How claims to know the future are used to understand the present. In C. Camic, N. Gross, & M. Lamont (Eds.), Social knowledge in the making (pp. 339-378). Chicagi, IL; London: Chicago University Press.

29. Moustafa, K. (2015), "Blind manuscript submission to reduce rejection bias?", Science and Engineering Ethics, Vol. 21 No.2, pp. 535-539.

30. Robinson, J. (1982), "Energy backcasting: A proposed method of policy analysis", Energy Policy, Vol. 10 No. 4, pp. 337-344.

31. Sandford, R. (2019), "Thinking with heritage: Past and present in lived futures", Futures, Vol. 111, pp. 71-80.

32. Sarkar, S., Bhatia, G., (2021), "Writing and appraising narrative reviews", Journal of Clinical and Scientific Research, Vol. 10 No.3, pp.169-172.

33. Schulz, K. A., Gstrein, O. J. & Zwitter, A. J. (2020), "Exploring the governance and implementation of sustainable development initiatives through blockchain technology", Futures, Vol. 122, pp.102611.

34. Snyder, H. (2019), "Literature review as a research methodology: An overview and guidelines", Journal of business research, Vol. 104, pp.333-339.

35. Song F., Parekh S., Hooper L., Loke Y.K., Ryder J., Sutton A.J., Hing C., Kwok C.S., Pang C. & Harvey I. (2010),

"Dissemination and publication of research findings: An updated review of related biases", Health Technology Assessment Vol. 14, pp.1-220.

36. Sturmberg J.P. (2011), "The illusion of certainty - A deluded perception?", Journal of Evaluation in Clinical Practice, Vol. 17, pp.507-510.

37. Torraco, R. J. (2005), "Writing integrative literature reviews: Guidelines and examples", Human Resource Development Review, Vol. 4, pp. 356-367.

38. Tranfield, D., Denyer, D., & Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", British Journal of Management, Vol. 14, pp. 207-222.

39. Van Lente, H. (2012), "Navigating foresight in a sea of expectations: Lessons from the sociology of expectations", Technology Analysis and Strategic Management, Vol. 24 No.8, pp.769-782.

40. Vergragt, P. J. & Quist, J. (2011), "Backcasting for sustainability: Introduction to the special issue", Technological Forecasting and Social Change, Vol. 78 No.5, pp.747-755.

41. Whiston, T. (1979), Introduction. The uses and abuses of forecasting, Sussex, UK: Science Policy Research Unit, Sussex University, 1-4.

42. Wilson D.B. (2009), "Missing a critical piece of the pie: Simple document search strategies inadequate for systematic reviews", Journal of Experimental Criminology, Vol.5, pp. 429-440.

43. Yoshii A., Plaut D.A., McGraw K.A., Anderson M.J. & Wellik K.E. (2009), "Analysis of the reporting of search strategies in Cochrane systematic reviews", Journal of the Medical Library Association, Vol. 97, pp. 21-29.