Data-Driven Technology Foresight in Data-Deprived Countries

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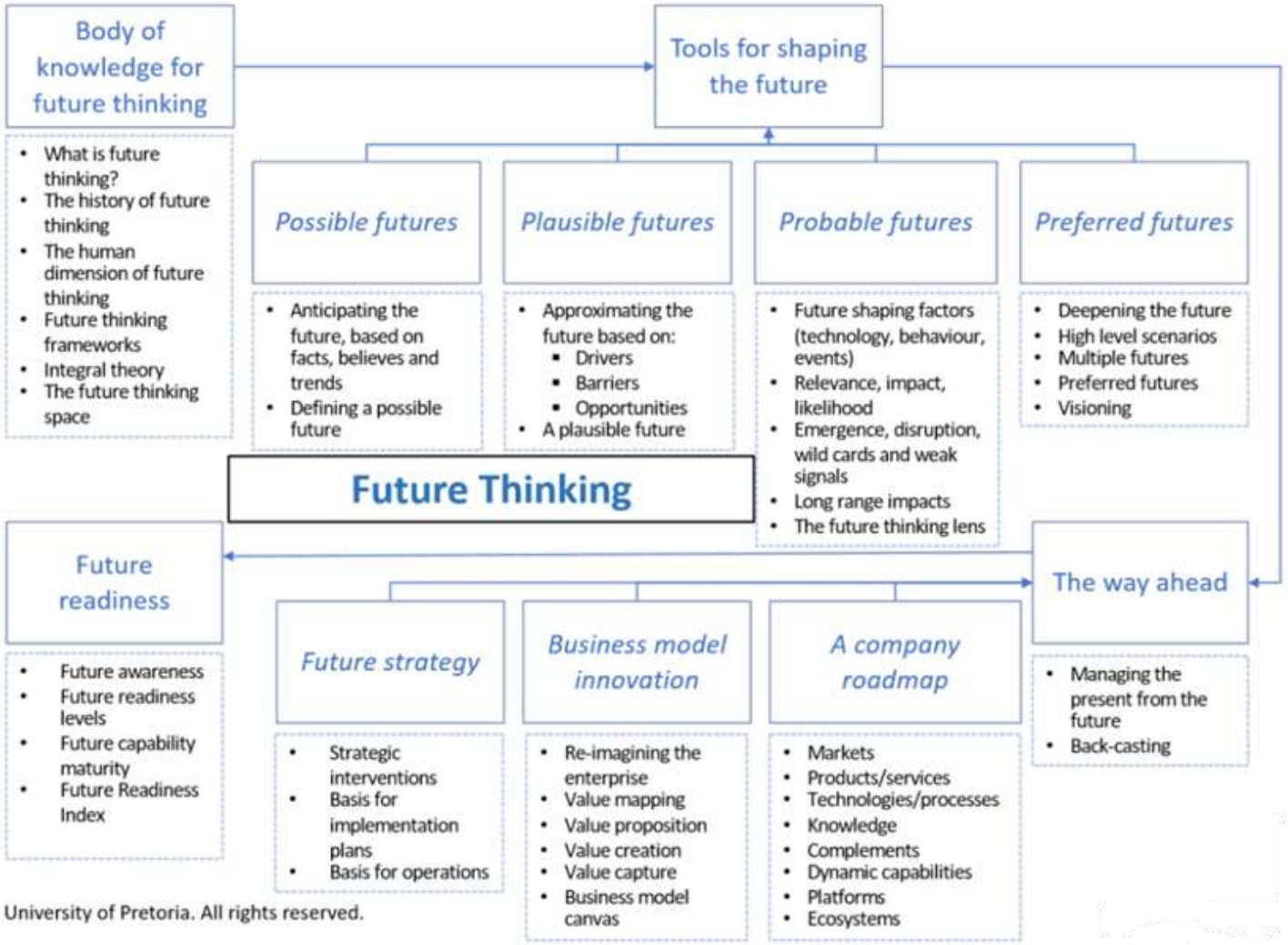
The Problem & Research Question

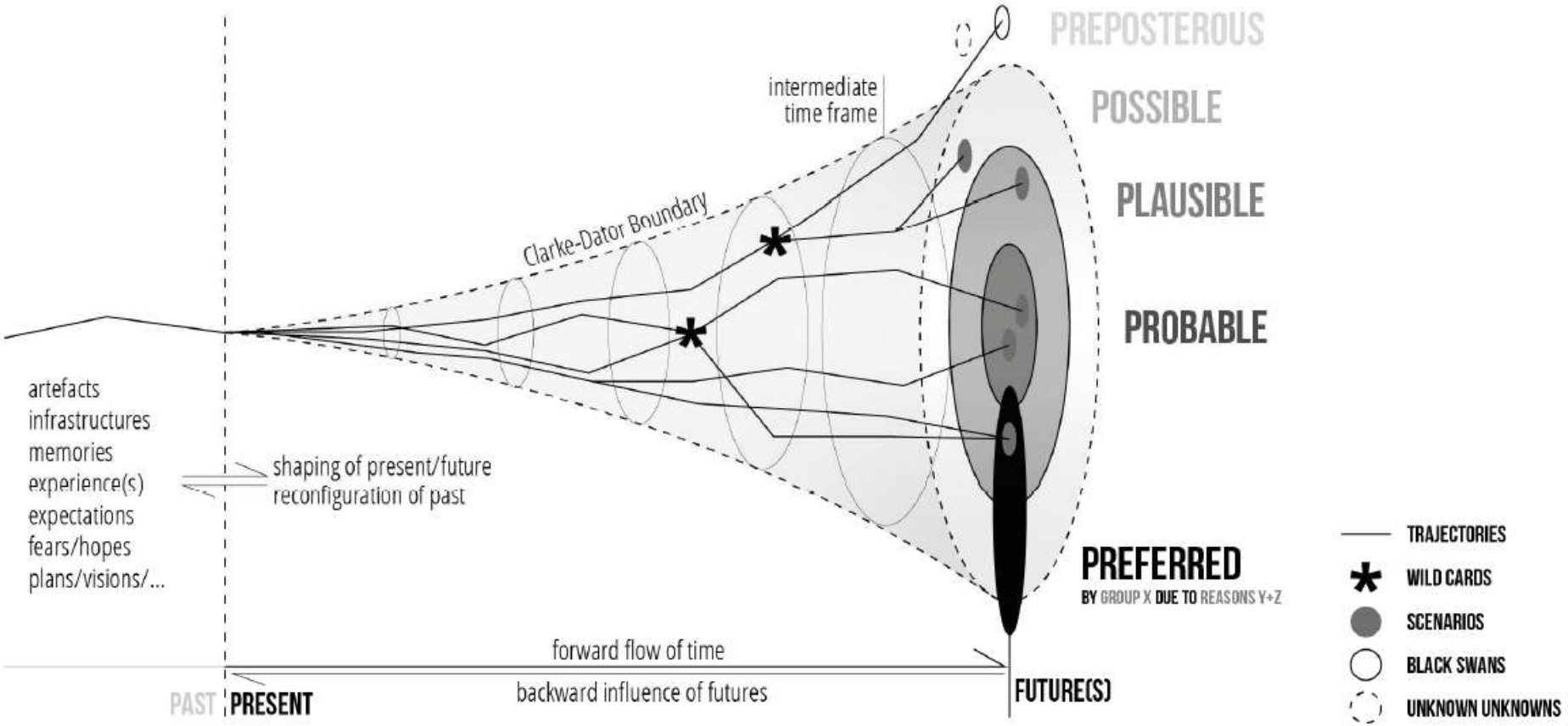
- **The Challenge:** Technology foresight is critical for national development, but is notoriously **resource-intensive and time-consuming**.
- Many countries in the Global South are “data-deprived,” - lacking established foresight institutions, which results in limited infrastructure, expert panels, and structured data to support traditional foresight methods.
- **The Opportunity:** The rise of Generative AI offers a potential tool for "rapid foresight” and gathering insights from unstructured data sources.
- **Research Question:** How can Generative AI effectively replicate or support formal technology foresight processes, especially in contexts with limited resources?

A Futures Thinking Framework



- We test the role of AI at the level of Possible, plausible, probable, and preferred futures

The Future Cone



Source: Gall, Vallet & Yannou (2022)

Human-Machine Co-operation in Technology Foresight

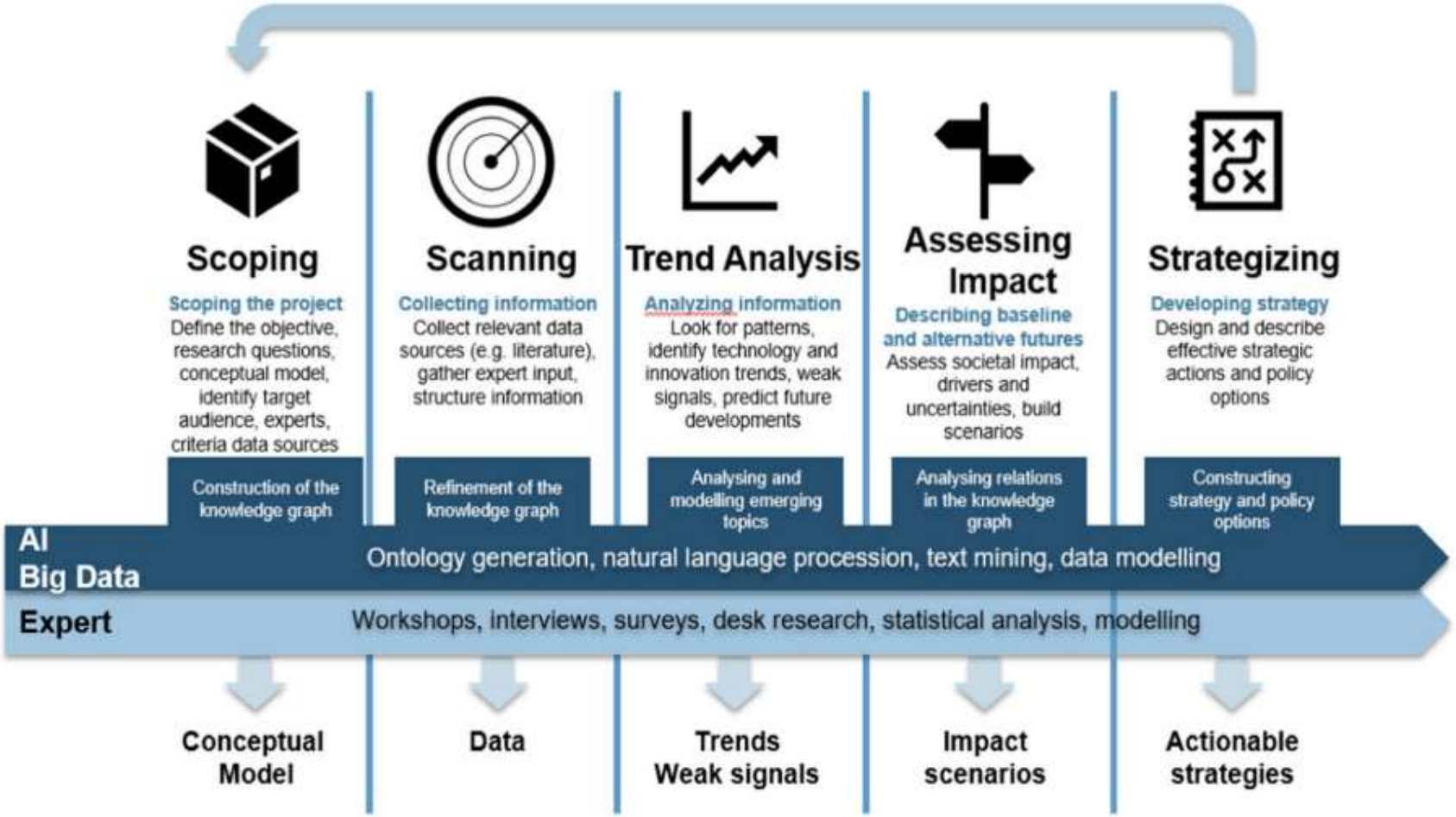


FIGURE 1: Hybrid artificial intelligence-expert foresight framework.

Source: Geurts *et al*. (2021)

- Literature shows the possibility of AI-human cooperation in facilitation of technology foresight exercise

The Rise of AI in Foresight (6th Generation)

Foresight is Evolving:

- **1st-5th Gen:** Focus shifted from tech experts to broader societal stakeholders.
- **6th Generation:** Characterised by big data, crowd-sourcing, and AI.
- **AI's Role:** To augment humans in searching, synthesising, and analysing vast amounts of information to identify signals and trends.

Our Approach: We test the potential of AI to substitute various stages of foresight – using a custom Generative AI model as a "Foresight Strategist."

Methodology: Designing the AI Foresight Strategist

- **Tool:** A custom GPT-4 model configured as a "Foresight Strategist."
- **Task:** To replicate the key outputs of national foresight exercises.
- **Case Studies:** Five countries were selected for analysis:
  - **Africa:** Botswana, South Africa
  - **Asia:** Japan, Malaysia, South Korea
- **Quality Assurance:** each prompt run 3 times to check for consistency, and the temperature level of GPT-4 was set at 0.6 (out of 1) to reduce creativity.

Results Overview: AI Performance Across Five Countries

We analysed official foresight reports from five nations with varying methodologies and planning horizons.

Table 1: Summary of Foresight Documents Assessed

Country	Year	Planning Horizon	Key Methods Used
Botswana	2023	2036 (13 yrs)	Visioning, Scenarios
South Africa	2019	2030 (11 yrs)	Scenarios, Big Data
Japan	2019	2050 (31 yrs)	Horizon Scanning, Visioning, Delphi, AI, Scenarios
Malaysia	2017	2050 (33 yrs)	Horizon Scanning, Scenarios
South Korea	2022	2045 (23 yrs)	Big Data, Delphi Survey

Results: AI is Strong at Identifying "Possible Futures"

At the initial, broad scanning stage, AI performance was high.

Table 2: AI Performance on Possible Futures

Country	# of Domains	AI Matches	% Match
Botswana	13	10	77.0%
Malaysia	284	158	55.6%
South Africa	80	54	67.5%
South Korea	241	154	65.1%
Average			**66.0%**

Implication: AI is an excellent tool for **horizon scanning** and generating a broad list of potential STI domains.

Results: AI's Performance Declines with "Probable Futures"

As we move to assessing likelihood and feasibility, the AI's alignment with human experts decreases.

Table 3: AI Performance on Plausible & Probable Futures

Country	# of Domains	AI Matches	% Match
Botswana	8	5	62.5%
Japan	16	11	68.8%
Malaysia	95	45	47.4%
South Africa	31	19	61.3%
Average			**60.0%**

Implication: Context-specific factors (politics, local capabilities) become more critical, areas where AI has limitations.

Results: The "Preferred Future" is a Human Domain

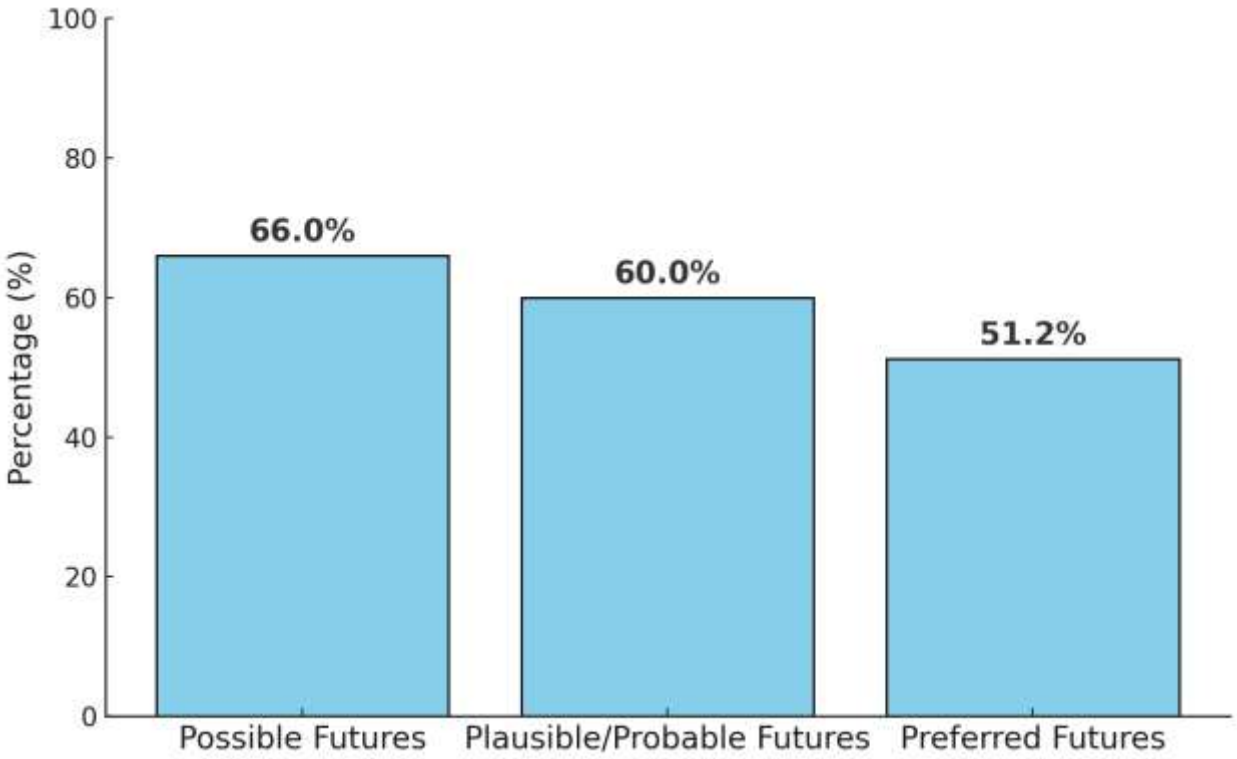
The largest drop in performance occurred when defining what a country prefers.

Table 4: AI Performance on Preferred Futures

Country	# of Domains	AI Matches	% Match
Botswana	7	4	57.1%
Japan	12	5	41.7%
Malaysia	21	9	42.9%
South Africa	9	6	66.7%
South Korea	15	7	47.7%
Average			**51.2%**

Implication: Defining a "preferred future" relies heavily on human judgment, values, and policy priorities that AI cannot fully replicate.

Visualising the Decline in AI Matching



Takeaway: AI's ability to replicate traditional foresight methods diminishes along the foresight funnel, as later stages demand deeper contextual understanding and more value-driven, human-centred decision-making.

Discussion: AI as a Complementary Tool

- **Strength in Scarcity:** For data-deprived countries, AI can rapidly scan the global landscape and unstructured data sources, providing a crucial **starting point** that would otherwise require significant expert manpower.
- **Not a Replacement:** The decline in matching percentages shows AI cannot replace the human elements of foresight: consensus-building, ethical consideration, and value-based prioritisation.
- **The Hybrid Model:** The optimal approach is a **human-AI collaboration**, where AI handles data-heavy lifting and humans provide contextual judgment.

Limitations & Future Research

- **Potential Bias:** The AI model had likely been trained on the very foresight documents we tested, potentially inflating match scores. Future work needs controlled input data.
- **Output Variability:** Slight variations were observed across multiple runs. Future studies should test the robustness of different LLMs (e.g., GPT-4, Claude, Llama) in this context.
- **Broader Application:** This methodology should be tested on more countries, especially those with nascent foresight systems.

Conclusion & Recommendation

- Generative AI is a powerful, scalable tool for the **early stages of technology foresight**.
- It is particularly valuable for **data-deprived countries** to kick-start their foresight processes and ensure they cover a wide range of global possibilities.
- However, it is a **complement, not a substitute**, for human expertise. The "preferred future" must be shaped by people.
- **Final Recommendation:** Integrate AI as a "Foresight Assistant" to enhance efficiency and scope, but keep human judgment at the center of strategic decision-making.

Questions

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Thank you!