



# Technologies of the Future in Post-1990 Science Fiction: A Case Study

Developing Science Fiction as Foresight Method

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**Foresight centre** develops Foresight methodology and performs future studies in S&T, innovation and socioeconomic area. In total more than 150 Foresight projects have been conducted by the centre's employees.

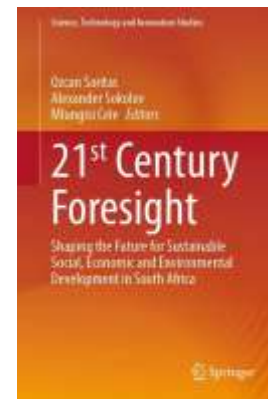
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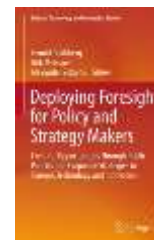
**Foresight of AI** is a study that aims at identifying key trends, drivers and barriers in recent AI development. We conducted expert interviews and foresight workshops with leading AI experts from BRICS countries

**Scenarios of IT sector for Russia** - project involved the development of four scenarios for the future of the IT industry in Russia and globally, as well as a description of all relevant industry trends for 2024



Сценарная матрица развития ИТ

		Потенциал международного сотрудничества	
		низкий/ снижающийся	стабильный/ растущий
Эффективность государственной поддержки развития технологий	высокая	Сценарий 1 Цифровой взлет ИТ-рынок в условиях цифрового суверенитета	Сценарий 3 Синергия инноваций Российские разработки в цифровом авангарде
	низкая	Сценарий 2 Мед. движение Другая стабильность ИТ-рынка	Сценарий 4 Цифровой паралич ИТ-рынок в оборотном движении



# **R** SCIENCE FICTION INSPIRES REAL WORLD CHANGES? OR PREDICTS?

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**Science fiction has a rich history of successfully predicting scientific and technological breakthroughs**

Ray Bradbury predicted in his novel “Fahrenheit 451” (1953) that walls in apartments will have screens. This has become true with modern indoor cinemas



Soviet illustration, 1950s



Modern indoor cinema

# INTRODUCTION

## RESEARCH QUESTION

What technological products depicted in science fiction works since 1990 have the greatest potential for realization? What are the prerequisites (needs) for the emergence of certain products?

## RESEARCH GOALS

- Analyze and identify **patterns** and **themes** in the portrayal of technological advancements and their societal implications
- Identify and catalog innovative **products** depicted in selected post-1990 science fiction works, documenting their characteristics and potential impacts on the STEEPV dimensions
- Identify the **most saturated markets** where technological products of a particular category predominate
- Identify the **needs** that preceded the emergence of a product on the market

## LIMITATIONS

This study focuses exclusively on science fiction **texts**, including those that have **inspired** films. This is because texts were most suitable for analysis, since any other form of science fiction required describing a product in a text form for analysis

While acknowledging the overlaps with other genres, the study distinguishes science fiction from fantasy and works that **do not strive for scientific plausibility** to focus on technological conceptions with a scientific basis



## KEY CONCEPTS

*Technology*: a systematized set of knowledge, tools, and methods used to create, modify, or improve products, processes, or services

*Product (SF-tech product)*: A technology depicted in SF as a deliverable solution—device, platform, infrastructure, organism, protocol, or service—embedded in a market area and tied to concrete user interactions, business/operational models, and governance

*Needs*: factors that precede the emergence of a product on the market; specific drivers of consumer demand that establish the necessity or desirability of a product

*Market*: an environment where a product is offered, exchanged, and consumed

*Class and subclass*: categories of scientific and technological products defined through machine learning based on their field of application or functional domain

# **R** THEORETICAL JUSTIFICATION OF THE METHODOLOGICAL POTENTIAL OF SCIENCE FICTION

*Foresight and science fiction have always been closely intertwined (von Stackelberg & McDowell, 2015) - the term "Foresight" itself was first coined by the renowned science fiction writer H.G. Wells in 1932*

**Many companies (Google, Microsoft, Apple) have hired science fiction writers to develop visions of the future and innovations:**

Technology giants sponsor lecture series where science fiction writers present to employees and conduct private meetings with developers and research departments. Companies commission "design fiction"—imaginative works to model new ideas and potentially commercial products

**Science fiction has been applied in the context of military forecasting in France and the United Kingdom:**

The French military engaged science fiction writers to **develop futuristic military scenarios** (Eljsberg, 2024), particularly for analyzing systems where direct study is unethical (e.g., lethal autonomous weapons or human augmentation). Similarly, the UK Ministry of Defence commissioned science fiction stories modeling future conflicts involving new technologies such as artificial intelligence and quantum computing (Moul, 2023). Event-driven scenarios in science fiction enable foresight practitioners to **anticipate which technologies will gain market traction** due to emerging societal needs shaped by critical events

**Researchers use science fiction analysis to formulate new scenario generation methods in foresight:**

Fergnani and Song (2020), for example, by analyzing science fiction films, formulated a new method for **generating scenarios** in Foresight, adapted to the need for organizations to prepare for sudden shocks.

Emphasizing the benefits of **"science fiction world-building"** for thinking about the future, some researchers (von Stackelberg & McDowell, 2015) call for more active use of science fiction in Foresight.

*From the film Interstellar (2014)*





## MANDATORY CRITERIA

**Year of publication:** the work must have been published after 1990, allowing for a focus on new, unrealized predictions

**Genre:** this criterion distinguishes science fiction from fantasy and other genres that do not claim scientific plausibility, while still encompassing a broad spectrum of literature. A total of 9 subgenres were identified

## ADDITIONAL CRITERIA

*(must meet at least 2 of 6)*

- **Awards:** the presence of awards indicates recognition of the work by the literary community and readership
- **Bestseller lists:** inclusion in bestseller lists indicates the work's popularity with both the general public and critics
- **Adaptations** (*including film and video games*): adaptations demonstrate the work's popularity and recognition among a wide audience
- **Number of translations** (*minimum 3*): a large number of translations points to the universality of the themes explored and recognition within the international literary community
- **Number of editions** (*minimum 2*): a high number of editions indicates the work's demand and literary value
- **Print run** (*minimum 100,000*): a large print run signifies commercial success and accessibility to a wide range of readers



# DATABASE OF SCIENCE FICTION TEXTS: DESCRIPTION AND DEMONSTRATION (EXAMPLE)

A database containing more than **100** science fiction works published since **1990** by authors from **17** countries was created. This period witnessed a rapid growth in information technologies, including among mass users. The collapse of the USSR, the accelerating pace of globalization, and the dot-com bubble all significantly contributed to the formation of new perspectives on the future.

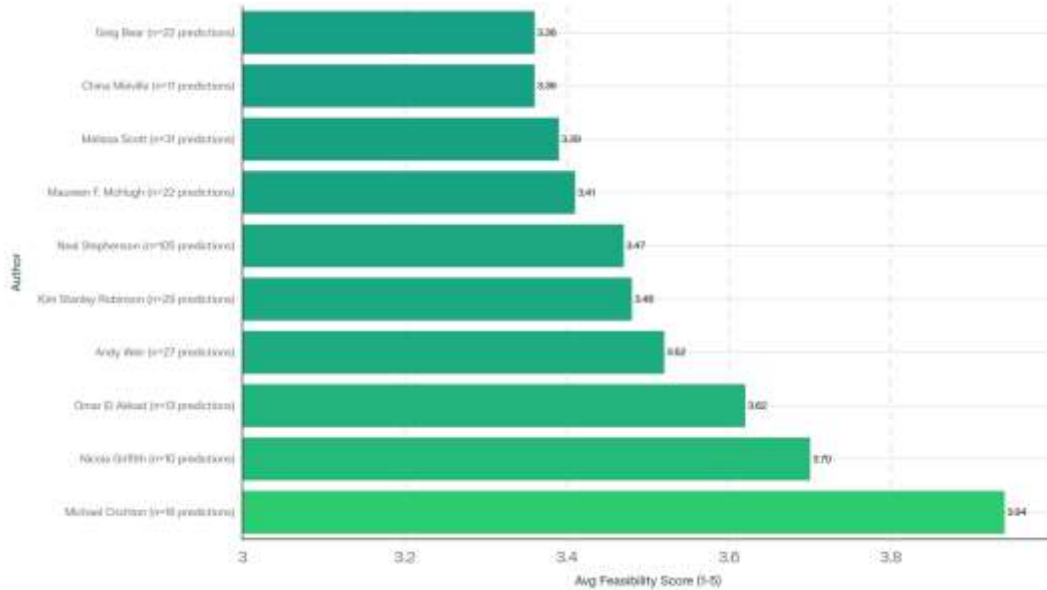
EXAMPLE DESCRIPTION

BOOK INFORMATION	
<i>Title</i>	Immunity Index
<i>Year of Publication</i>	2021
<i>Author</i>	Sue Burke
<i>Country of Origin</i>	United States
<i>Number of Translations</i>	2
<i>Number of Editions</i>	1
<i>Number of Awards</i>	1
<i>Genre</i>	Hard Science Fiction, Social Science Fiction

STEEPV THEMES COVERED IN THE BOOK	
<b>SOCIAL</b>	Isolation; cultural changes; changing definitions of self; individuality vs. conformity; social inequality; questions of community and solidarity; breakdown of social order
<b>TECHNOLOGICAL</b>	Changing nature of work; consequences of technology
<b>ECONOMIC</b>	Poverty; income inequality; access to resources; economic collapse
<b>ECOLOGICAL</b>	-
<b>POLITICAL</b>	Collapse of public order; resistance; struggle for freedom; government surveillance; social upheaval
<b>VALUES</b>	Ethical choices; responsibility; self-determination; justice

BOOK SYNOPSIS

In a future America plagued by shortages and a totalitarian government, three women discover they are clones. A deadly virus emerges, and the clones – Irene, Catherine, and Liz – struggle to survive amidst chaos and rebellion. Their creator, Peng, races to find a cure and uncovers a conspiracy. *Immunity Index* explores themes of genetic engineering, social injustice, and human resilience.



The analysis of individual authors reveals that **Michael Crichton achieves the highest average feasibility score of 3.94 among authors with at least 10 (5-score) technology predictions (16 predictions total)**. Crichton's scientific background and focus on near-future biotechnology and computer science scenarios likely contribute to this high feasibility rating. His works, including themes around genetic engineering, nanotechnology, and artificial intelligence, anticipated technologies that have seen substantial development in recent decades

**Nicola Griffith** ranks second with a 3.70 feasibility score across 10 predictions, followed by **Omar El Akkad** at 3.62 (13 predictions). **Andy Weir** demonstrates consistent feasibility at 3.52 across 27 predictions, reflecting his engineering-oriented approach to science fiction exemplified in works like "The Martian." **Kim Stanley Robinson** completes the top five at 3.48 with 29 predictions, notable for his detailed extrapolations of climate science, space colonization, and societal transformation

While **Neal Stephenson leads in volume with 105 technology predictions** (representing 7.8% of the entire database) he does not appear in the top five by feasibility score, suggesting his work spans a broader range from near-future plausibility to more speculative scenarios. This volume-versus-feasibility trade-off indicates that authors who predict more technologies may naturally include more speculative concepts, while those with fewer but more focused predictions can maintain higher average feasibility scores

The author analysis reveals that feasibility correlates strongly with **technical background and narrative focus on near-future scenarios**. Authors who ground their speculative technologies in existing scientific principles and incremental advancement tend to achieve higher feasibility ratings than those exploring more radical departures from current technological paradigms



First products were selected from texts using LLM, then they were manually coded by a number of researchers. In total more than 20 people have worked on the database marking more than 1300 products

The methodology employed a multi-stage process that combined automated data extraction with rigorous manual validation, consisting of the following key phases:

1. *Automated extraction.* We used large language model (LLM) APIs (in particular, Google AI Studio) to perform the initial extraction of data concerning technologies and their descriptions from the corpus of texts.
2. *Manual validation.* All machine-extracted information was then manually reviewed and verified by researchers to ensure accuracy, correct any errors, and confirm contextual appropriateness.
3. *Iterative categorization.* The classification system was developed using a hybrid inductive-deductive approach. An initial set of categories was created inductively from a subset of the data, which was then tested and refined through deductive application to the remainder of the database.

## EXTRACTING PRODUCTS FROM BOOKS

### 1-Step: LLM Prompting

"Hello! Now you have a task, which consists of finding predictions and technologies from works of science fiction: I will send you a book in the genre of science fiction in PDF format, and your task is to find technological concepts and technologies from this book (the search must be carried out by 100 pages in the book, then I will write continue searching in the book):

1. Determine whether the sent book corresponds to the genre of science fiction? 2.

Name of the technology from the book

2. Detailed description of this technology (if available and it is possible to describe the technology)

3. Identify the class of this technology: ...

4. Identify the subclass of the technology: ...

5. Evaluation of the Magnitude of influence on society of the technology: ...

6. Determine the type of forecast: ...

7. Evaluation of the Target audience: ...

8. Determine the assessment of the degree of implementation on a scale from 1 to 5 (where 1 is the least likely to be implemented, and 5 are implemented and already implemented) - give a detailed justification for this solution

**IMPORTANT NOTES:**

-- Do not use third-party materials in your work, rely only on the PDF file sent to you

-- Only analyze 100 pages of the book, if the book has more than 100 pages, ask to continue analyzing 100-200, 200-300, and so on (for every 100 pages there should be at least 5-10 forecasts/technologies)

-- This is an important research task, try not to make mistakes and act wisely

Explain how you understood this task?"

## TO VERIFY THE AVAILABILITY OF THE PRODUCT IN THE BOOK

### 1-Step: LLM Prompting

"Hello! Now you have a task that consists of checking forecasts and technologies from works of science fiction: I will send you a book in PDF format and some of the concepts that are found in this book, your task is to determine:

1. Is this technology (forecast) present in the book? (if yes, provide a detailed description of the technology from the book)

2. Is this concept directly a technology?

3. Define the class of this technology: ....

4. Define the subclass of the technology: ...

5. Determine the Forecast type: Realistic, Hypothetical, Fantastical

6. Determine the Estimation of the degree of realization on a scale from 1 to 5 (where 1 is the lowest probability of realization, and 5 are realized and already implemented) - give a justification for this decision

**IMPORTANT NOTES:**

-- Do not use third-party materials in your work, rely only on the sent PDF file

-- This is an important research task, try not to make mistakes and act reasonably

Explain how you understood this task?"

### 2-Step: Expert coding and verification

## TEXTUAL FEATURES

- Name of the technology and the text describing it
- A brief description of the technology in 1-2 sentences
- Narrative year, if specified in the work.
- The year of publication of the book in which the product is mentioned
- Text description from the book

## APPLIED CLASSIFICATION

- Product class and subclass obtained using machine learning method
- Economic activity category (OECD)
- Target audience
- Magnitude of influence on society
- Similar realized technologies
- Type of forecast
  - realistic
  - hypothetical
  - fantastical

## MARKET CHARACTERISTICS

- **Primary market area**  
*Defines the main sector or industry in which the technology is positioned, identifying the dominant user groups, geographic regions, and application domains where the product is most likely to be adopted*
- **Needs**  
*Specifies the underlying consumer or societal demands that drive the development and adoption of the technology, highlighting the key problems, desires, or pain points the product addresses*



Technology name	Description of technology	Book title	Year of narrative	Year of publication	Author	Genre	Cybersex	Magnitude of influence on society	CEED economic activity category	Forecast type	Target audience	Primary market area	Needs (Demand)	Needs (Demand)
Chatbot	A social VR communication system based on the accuracy of sensory impressions recorded in a neural interface. Users can view pictures, text and receive facial impressions.	Ready Player Two	-	2020	Ernest Cline	Иллюстративные ИТ технологии	Прогностические социальные сети, VR/AR системы	Positive	IT and other information services	Realistic	Children (teenagers)	Chatbot	Sharing fully-sensory experiences with others in real time	
Orbit Star Pines	Small energy-generation systems located in Earth's orbit, generating energy to Earth via microwave radiation.	At the Edge of the Ocean	-	1990	Kim Stanley Robinson	Экзотика, Роботы	Генерация в космосе, распределенная вычислительная инфраструктура	Major	Air and spacecraft and related machinery	Technological	Children	Orbit Star Pines	Generating abundant clean power off-planet	
Anti-Protection Suits	Chemical spray that protects virtual structures from swarms, making them impervious to bots.	American War	2075	2017	Oron El Assadi	Материалы и смеси	Новые материалы	Positive	Chemicals and chemical products	Technological	Children (teenagers) Children (adults)	Anti-Protection Suits	Surviving and operating in hostile (space) environments	
Projection Lenses	Wearable Reality (VR) devices in the form of lenses to display specific content directly into the eyes.	Star Beach	-	1992	John Varley	Персональные технологии	Виртуальные миры, VR/AR системы	Positive	Medical and dental instruments IT and other information services Agriculture and manufacturing activities	Technological	Children (teenagers) Children (adults)	Projection Lenses	Displaying rich 3D or holographic data	
Direct Interface	A form of computer interface that allows that input to a personal computer using thought power, replacing keyboards.	Star Beach	-	1992	John Varley	Иллюстративные ИТ технологии	Интерактивные системы, коммуникация	Major	Machinery and equipment (incl. Electrical equipment) Medical and dental instruments Computer, electronic and optical products	Technological	Scientific organizations Children (teenagers) Children (adults)	Direct Interface	Tuning thoughts directly instead of commands	
Innovative Masked	Devices product that detects a person's emotional state and applies medical according to their mood.	The Diamond Age	-	1995	Neal Stephenson	Персональные технологии	Виртуальные миры	Positive	Chemicals and chemical products	Technological	Children (teenagers)	Innovative Masked	Responding autonomously through operations	
NeuroInterface	A device implanted in the brain, allowing neurons to interact directly with computers and other devices.	Mother of Storms	-	1994	John Barnes	Иллюстративные ИТ технологии	Интерактивные системы, коммуникация, Киббернетика/киберпространство	Positive	IT and other information services Medical and dental instruments	Realistic	Children (teenagers) Children (adults)	NeuroInterface	Tuning thoughts directly instead of commands	
Digital Currency	Digital currency with a built-in system for secure and anonymous payments, potentially using strong cryptography and decentralized networks.	Cryptonomicon	-	1999	Neal Stephenson	Иллюстративные технологии	Новый бизнес, Киббернетика	Positive	Financial and insurance activities Software publishing	Realistic	Children (teenagers) Children (adults)	Digital Currency	Paying and paying debts without cash or credit	
Gene Factory	Substrate equipment and computers designed to clone animals and manufacture a gene factory studies also DNA sequencing and other similar operations.	Jurassic Park	-	1989	Michael Crichton	Безопасность	Биотехнологические предприятия / ГМО	Major (N.S.)	Medical and dental instruments	Technological	Scientific organizations	Gene Factory	Manufacturing biological and genetic code	
Robot for Asteroid Resource Extraction	Large robots used for asteroid mining, loading, and using materials for the long-term needs of space missions.	The Martian	-	1998	Andy Weir	Робототехника	Промышленные роботы, Космические аппараты и космическая инфраструктура	Major (N.S.)	Mining and quarrying Air and spacecraft and related machinery	Realistic	Children	Robot for Asteroid Resource Extraction	Mining, refining, and building infrastructure in space	
Tel-to-Speech Technology	An electronic device capable of converting text into speech.	The Deep Range	-	1999	Walter Vinge	Иллюстративные ИТ технологии	Параллельные системы, Системы обработки информации, Системы хранения и передачи данных / удаленные данные, Виртуальные коммуникационные	Positive	Agriculture and manufacturing activities	Realistic	Children (teenagers) Children (adults) Scientific organizations	Tel-to-Speech Technology	Enhancing or restoring communication abilities	
Virtual Assistant "Thinkie Helper"	A computer module based on a neural network, capable of performing background tasks like information retrieval, analysis, and data processing.	Quantique	2034	1992	Greg Egan	Иллюстративные ИТ технологии	Системы хранения и передачи данных / удаленные данные, Виртуальные коммуникационные	Major (N.S.)	Scientific research and development	Technological	Children (teenagers) Children (adults)	Virtual Assistant "Thinkie Helper"	Delegating background work and information triage to AI	
Metacrawler	A neural interface-based computer module that retrieves information about people, including names, logographs, and relevant data, as well as tracks the user interacting with.	Quantique	2034	1992	Greg Egan	Иллюстративные ИТ технологии	Системы хранения и передачи данных / удаленные данные / удаленные данные, Цифровые технологии	Major (N.S.)	IT and other information services	Technological	Children (teenagers) Children (adults)	Metacrawler	Delegating background work and information triage to AI	
Simulator	A neural interface-based computer module that creates realistic simulations for training and education in virtual environments.	Quantique	2034	1992	Greg Egan	Иллюстративные ИТ технологии, Виртуальные технологии	Системы хранения и передачи данных / удаленные данные, Цифровые технологии	Positive	IT and other information services	Realistic	Children (teenagers) Children (adults)	Simulator	Training, drilling, or preparing safety/real-world-like situations	
Supercomputer "Quantum Logic"	Highly intelligent computational machine capable of quantum computing, used for managing experiments and measuring results.	Heads	-	1998	Greg Bear	Иллюстративные ИТ технологии	Суперкомпьютеры	Positive	Computer, electronic and optical products	Technological	Scientific organizations	Supercomputer "Quantum Logic"	Running advanced bio- or quantum computers of jobsites	
Nuclear Ice Engine	An engine for high-speed spacecraft, utilizing atomic energy from a nuclear reactor to generate thrust and electricity (incl. Advanced agricultural systems capable of producing food in space using silencing/learning technologies).	The Martian	2035	2011	Andy Weir	Космос	Космическая инфраструктура, Сверхскоростные перевозки, Переходы и распределенные вычисления	Positive	Electricity, gas and water supply, waste (incl.)	Technological	Children	Nuclear Ice Engine	Traveling with respiratory challenges with minimal fuel	
Bioprinted Food Systems	Advanced agricultural systems capable of producing food in space using silencing/learning technologies.	Severance	-	2010	Neal Stephenson	Сельскохозяйственные технологии	Иллюстративные методы, фермерство	Positive	Agriculture, forestry and fishing (incl. air and spacecraft and related machinery)	Technological	Children (teenagers) Children (adults) Scientific organizations	Bioprinted Food Systems	Growing or printing food when soil and sunlight are scarce	
Robot	A robot designed to provide medical assistance.	Run from the Light of Heaven	-	2021	Tabi Thompson	Защита	Обработка медицинских данных, Социальные роботы	Positive	IT and other information services Air and spacecraft and related machinery Medical and dental instruments	Realistic	Children	Robot	Resolving post-acute-care medical care	
Self-Replicating Robots	Robots capable of self-replication, designed to extract raw materials from rocks and other items in space.	Mother of Storms	-	1994	John Barnes	Робототехника	Промышленные роботы	Major	Machinery and equipment (incl.)	Technological	Children (teenagers) Children (adults)	Self-Replicating Robots	Forming physical objects on demand from raw feedback	
Mind Scanning and Copying Technology	Technology that scans the human brain to digitally copy consciousness, transferring it to a virtual environment.	The City and the Stars	-	1995	Greg Egan	Иллюстративные ИТ технологии	Цифровые коммуникации	Major (N.S.)	Software publishing IT and other information services Scientific research and development	Technological	Children (teenagers)	Mind Scanning and Copying Technology	Backup, archiving or cloning as a digital self	



## EXAMPLES OF NOTABLE TECHNOLOGIES: ONI-NET

13



*«We held our co-owners meetings here instead of in a standard OASIS chatroom because it allowed all sorts of additional security measures to be taken, to prevent anyone from recording or eavesdropping on us, including our own employees»*

<b>Technology name</b>	ONI-net
<b>Product</b>	A social VR communication platform based on the exchange of sensory impressions recorded by a neural interface. Users can view, purchase, rate and review these impressions
<b>Brief description of the conception</b>	Platform for social networks based on the exchange of sensory impressions recorded with the help of the neural interface OASIS (ONI). Users can view, purchase, evaluate and revisit these impressions.
<b>Text</b>	<i>Ready Player Two</i>
<b>Author</b>	Ernest Cline
<b>Year of publication</b>	2020
<b>Class</b>	Information and IT technologies
<b>Subclass</b>	Advanced social networks, VR/AR systems
<b>Technology type</b>	Speculative
<b>Type of social influence</b>	Positive
<b>Forecast type</b>	Realistic
<b>Primary market area</b>	Entertainment and Recreation
<b>Needs</b>	Sharing fully-sensory experiences with others in real time



## Examples of notable technologies: Replicators

14



«The replicators were made in deliberate imitation of life, which is highly efficient at spreading itself around, binding energy from sunlight, and extracting scarce elements from abundant minerals»

<b>Technology name</b>	Replicators
<b>Brief description of the conception</b>	Self-replicating robots, capable of extracting raw materials from the environment, processing them, and creating copies of themselves. They are intended as a means of automated resource extraction and production in space.
<b>Text</b>	<i>Mother of Storms</i>
<b>Author</b>	John Barnes
<b>Year of publication</b>	1994
<b>Technology type</b>	Speculative
<b>Type of STEEPV influence</b>	Positive
<b>STEEPV influences</b>	Unforeseen consequences of mass technology use; infrastructure development; replacement of humans by technologies; overcoming natural laws; sustainable development; ethical aspects of technology use



## Examples of notable technologies: Body restoration



«He didn't think he had quite believed what he had heard about the Culture's altered physiology until then. He hadn't accepted that they had changed themselves so. He had not believed that they really had chosen to extend such moments of pleasure, let alone breed into themselves all the multifarious drug glands that could enhance almost any experience (not least sex). Yet – in a way – it made sense, he told himself. Their machines could do everything else much better than they could; no sense in breeding superhumans for strength or intelligence, when their drones and Minds were so much more matter- and energy-efficient at both. But pleasure... well, that was a different matter»

<b>Technology name</b>	Body restoration
<b>Brief description of the conception</b>	Regeneration of damaged body parts, organ implantation, growing new organs, slowing down the aging process, and rejuvenation.
<b>Text</b>	<i>Use of Weapons</i>
<b>Author</b>	Iain M Banks
<b>Year of publication</b>	1990
<b>Technology type</b>	Hypothetical
<b>Type of STEEPV influence</b>	Negative
<b>STEPPV influences</b>	Shifting values; technology dependence; human-machine integration; control and agency

# PREDOMINATING BOOKS STEEPV THEMES IN EACH DECADE | 16

STEEPV Category	1990s	2000s	2010s	2020s
SOCIAL	Growth of social inequality, crisis in communication, escape into virtual worlds	New social movements, cultural changes	Identity search, alienation	Impact of digital technologies on social interaction, search for identity
TECHNOLOGICAL	Replacement of people by AI/machines, transhumanism, growth of cybersecurity	Technological disasters, unintended use of technologies	Automation, AI in the workplace	AI integration, infrastructure development, enhanced cybersecurity
ECONOMIC	Economic inequality, automation of labor	Changing nature of work, rise of economic inequality	Universal basic income, income inequality, new economic models	Emerging economic models due to AI/machine labor, resource access concerns
ECOLOGICAL	Global warming, sustainability innovations	Exploitation of nature, rise of environmental consciousness	Harmony with nature, dealing with ecological disasters	Sustainability, eco-innovation, addressing ecological crises
POLITICAL	Government control over technologies, cyber wars, information security	Use of technology in political struggles, war, international tech cooperation	Collapse of social order, cyber conflicts, revolutionary movements	Tech-based geopolitical strategies, cyber threats
VALUES	Ethical aspects of technology use, reconsideration of life and death	Responsibility, ethical choices regarding technology	Responsibility, sacrifice, ethical dilemmas in future contexts	Ethics of technological impact on human nature, questions of identity

Persistent themes include social and economic **inequality**, evolving alongside **technological** solutions like automation and AI.

Environmental consciousness **matures** from addressing global warming to **exploring** sustainable innovations and confronting ecological **crises**.

The technological focus shifts from early anxieties about job displacement to considerations about the **ethical implications** of AI and its role in shaping future infrastructure.

The political narrative shifts from concerns about **government control over information** to navigating technologically driven geopolitical strategies, cyber threats, and the potential for technology to both disrupt and empower social movements.

A consistent theme is the ongoing exploration of technology's impact on **core human values**, including the search for a good life in a technologically saturated world.

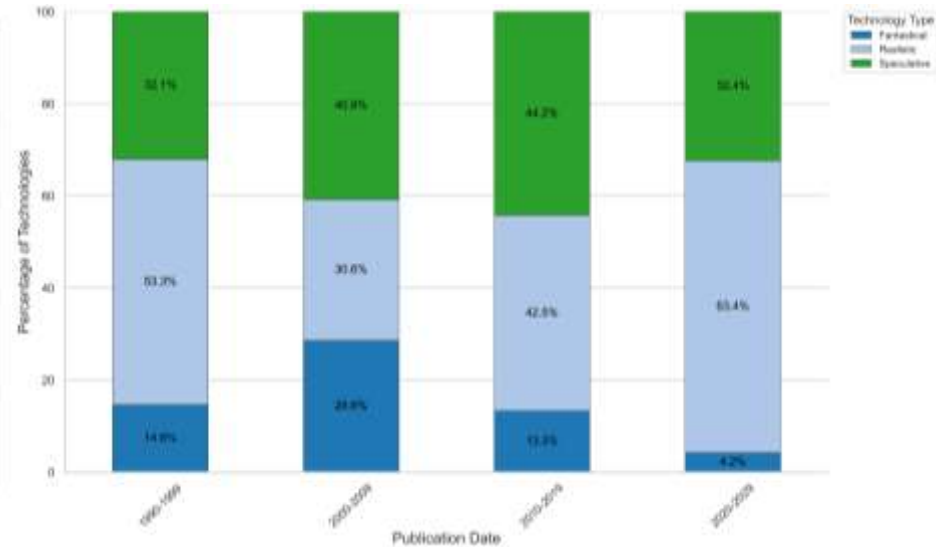
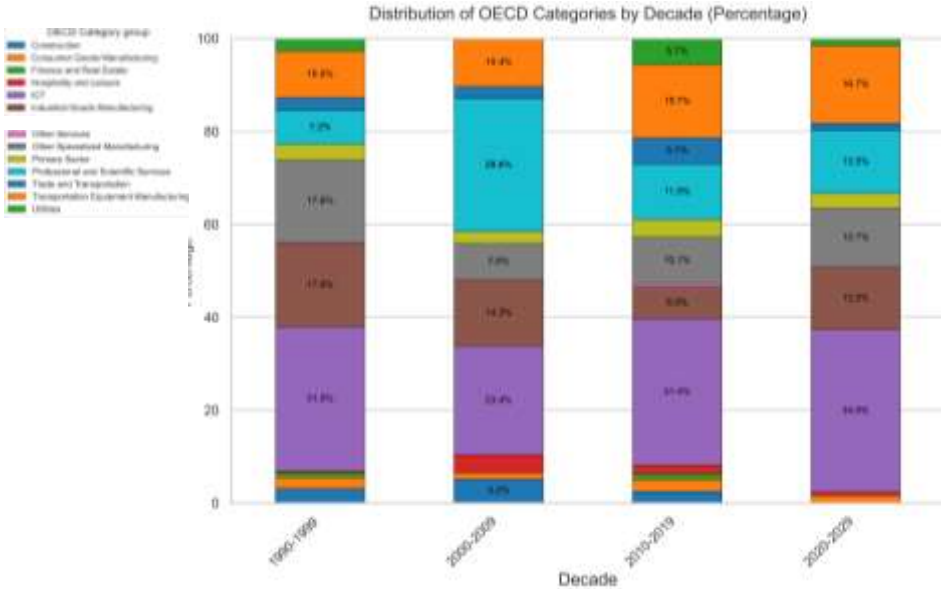


# PRELIMINARY RESULTS



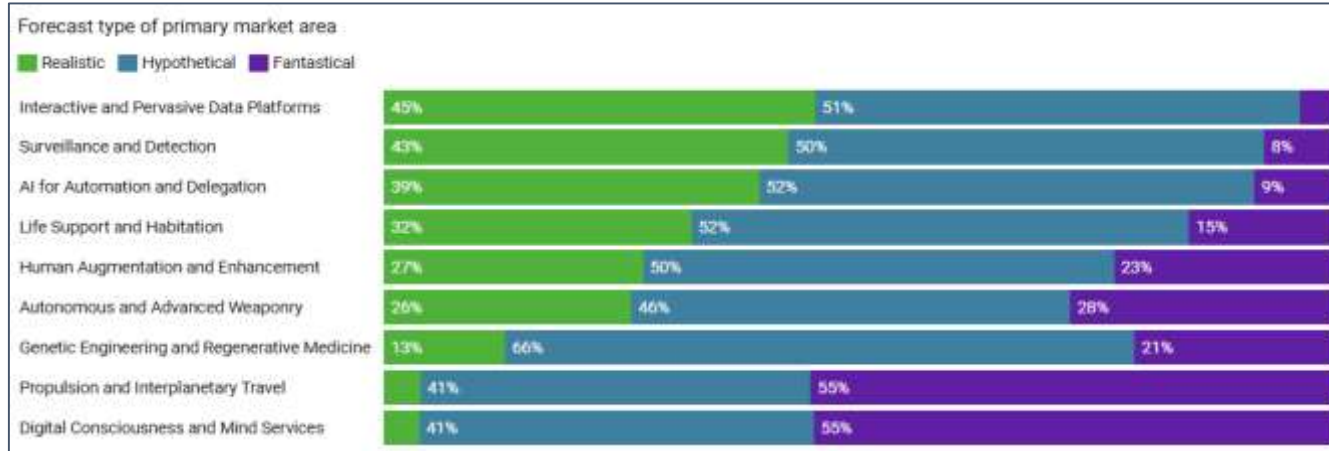
# TEMPORAL CHANGES IN REPRESENTATION OF TECHNOLOGY

19



- While the share held by ICT remains relatively stable (with the exception of a reduction in the 2000s, likely attributable to the dot-com bubble burst), the share held by professional and scientific services shows substantial variation, rising dramatically in the 2000s in contrast to the more industrial goods-focused 1990s.
- Additionally, we observe a steady increase in technologies related to consumer goods manufacturing, which may be linked to the gradual spread of globalization and capitalism.

- Over time, science fiction has shifted towards a more grounded portrayal of technology, reflecting an evolving understanding of scientific principles and technological limitations.
- The peak of fantastical technology depictions in science fiction appears to have occurred around the turn of the 21<sup>st</sup> century, which may be linked to the rapid technological advancements and societal anxieties surrounding the dawn of the new millennium.

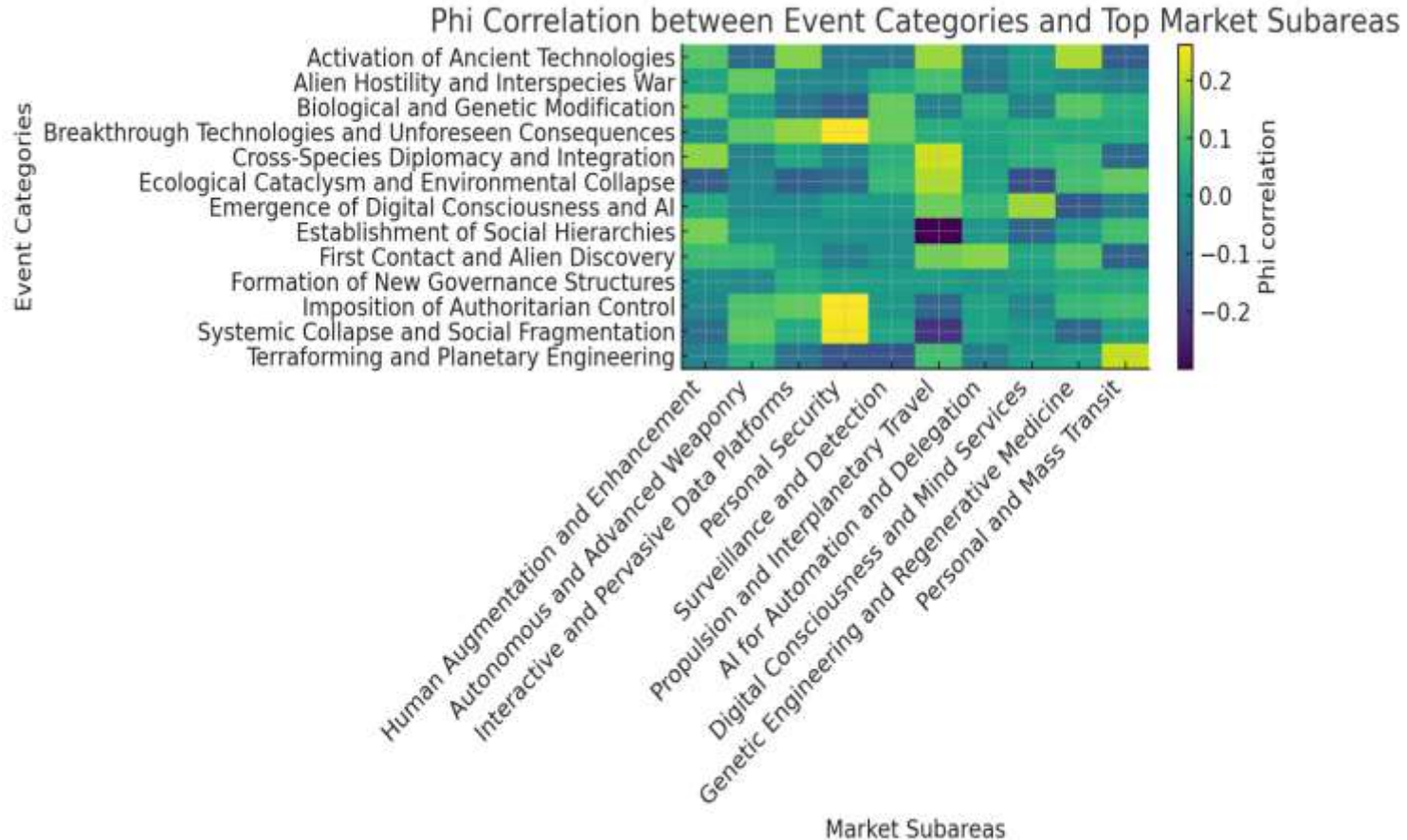


The top-10 market area chart reveals a sophisticated authorial calibration between physical feasibility and implementation barriers. Information-centric technologies receive realistic classifications reflecting their partial deployment; engineering-intensive technologies receive hypothetical classifications reflecting their feasibility but constrained timelines; physics-challenging technologies receive fantastical classifications reflecting genuine scientific uncertainty

The consistency of the hypothetical plateau (41-66% across all markets) demonstrates that science fiction reliably targets the "believable-but-unrealized" category as its core narrative domain—neither dwelling excessively on current reality nor abandoning plausibility for pure fantasy. This pattern offers valuable insights into technology forecasting: the hypothetical category represents where meaningful innovation narratives and realistic development timelines intersect

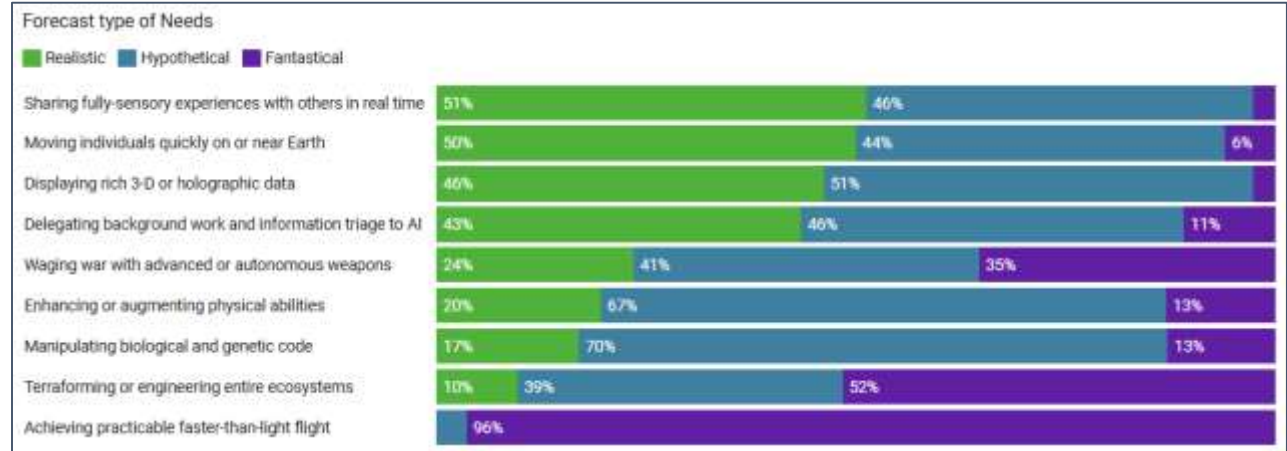


# Market Subareas and Event Groups – Co-occurrence



## Top-10 Needs by Forecast type

The top-10 needs chart reveals sophisticated authorial calibration between human aspirations (represented by needs) and perceived technical feasibility. Authors demonstrate clear understanding of which needs are nearly solvable (sensory sharing, transportation), which require sustained development (genetics, robotics, AI), and which approach fundamental limits (terraforming, FTL)



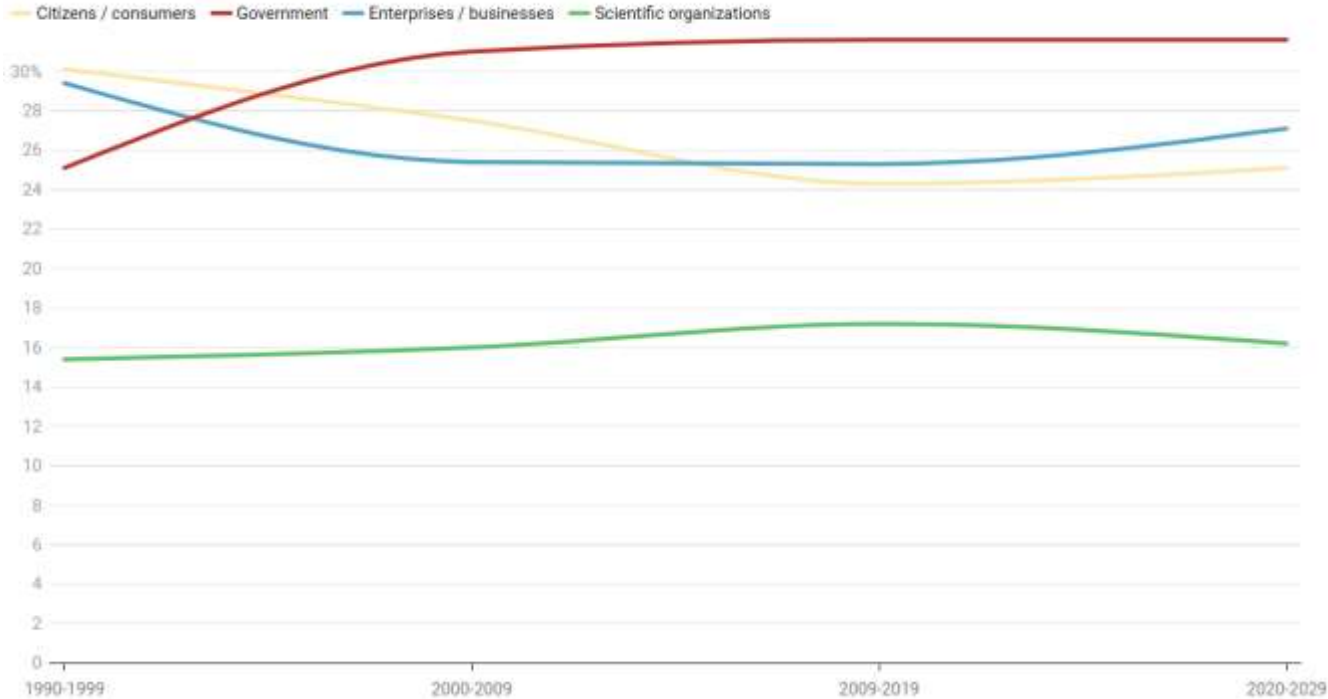
The hypothetical plateau at 40-70% across most needs validates science fiction's core narrative domain: technologies that are clearly conceivable and potentially achievable within extended timescales, yet face substantial current barriers. This "believable-but-unrealized" category represents where the tension between human aspiration and technical reality generates compelling narrative possibilities

The most revealing finding is that authors distinguish between enhancement (speculative) and restoration (realistic), suggesting recognition that extending human capability beyond biological baselines requires greater technical and speculative effort than restoring normal function



# EVOLUTION OF TARGET AUDIENCES FOR SCIENCE FICTION TECHNOLOGIES

Target audience of Products by decades



The most significant finding is the 1990s-2000s inversion: the 1990s showed consumer-business parity (30.1% consumers vs. 29.4% business) with government trailing (25.1%), while by the 2010s-2020s, government leads decisively (31.6%) with consumers lowest (24-25%). This shift reflects science fiction's recognition that state actors increasingly drive technological development and deployment in areas like surveillance, infrastructure, AI governance, and national security—a pattern mirroring real-world concentration of technological power in government institutions

<b>Closed-Loop Life Support Systems</b>	Systems that provide air, water, and food regeneration in cybernetic factories, allowing them to function autonomously for extended periods. Source: Mindstar Rising by Peter F. Hamilton (1993)
<b>Interstellar Spaceship</b>	An advanced spacecraft capable of traveling vast distances at near-light speed using warp drive. Source: Light From Uncommon Stars by Ryka Aoki (2021)
<b>Direct Interface</b>	A form of computer interface that allows you to input text into a computer by thinking. Source: Steel Beach by John Varley (1992)
<b>Biocomputers</b>	Computing systems that combine biological elements to perform complex calculations with increased efficiency. Source: Blindsight by Peter Watts (2006)
<b>Ecosphere Bomb</b>	A device that uses nanobots to terraform a planet, making it habitable for another species. Source: Edge of Tomorrow by Hiroshi Sakurazaka (2004)
<b>Matter Transmitter</b>	A device that can convert a human body into a stream of data, transmit it over vast distances at the speed of light, and then restore it in a new body. Source: Schild's Ladder by Greg Egan (2002)

There is a dominance of **space technologies** among the jokers, primarily for **interstellar travel**. This explains the presence of self-replicating system technologies necessary for maintaining near-light speed flight devices, as well as planet terraforming technologies

There are also more **realistic joker technologies** that address similar needs, such as artificial light sources for Earth, rapid takeoff systems, and air purification spheres to address climate change issues

In addition to the space and environmental fields, technologies that radically **expand human cognitive abilities**, turning humans into computational systems and simplifying interaction with machines, have a significant presence

## Most encountered technology user experience, technical features and functionality

- **Autonomy** and **visual perception** are the most frequently mentioned, highlighting the focus on self-sufficiency and sensory interaction in technological innovations.
- **Tactile feedback** and **mechanical control** are significant, indicating the importance of direct user interaction with devices.
- **Processor power, sensor integration, and battery life** are key features, reflecting the demand for performance, precision, and longevity in tech products.
- **AI-driven functions** and connectivity options suggest a growing emphasis on smart technologies and interconnected systems.
- Similar to functionality, **autonomy and visual perception** are top priorities, showing the importance of a smooth and independent user experience.
- **Ease of use** and **reliability** also rank high, emphasizing the user-friendly and dependable nature of products.

**APPLICATION**

# PRODUCT AND TECHNOLOGY CARDS FOR FORESIGHT WORKSHOPS

## Пищевые принтеры



Принтеры, которые создают продукты питания из сырья (переработанных отходов)

-  Производство и распределение пищи, Переработка отходов
-  Тактильный интерфейс, Автономность
-  Органические материалы, Биотехнологии, Самовоспроизведение

Целевая аудитория 

## Воздухоочистительные купола



Защитные купола, очищающие воздух в радиационно загрязнённых зонах

-  Создание изолированных сред, Очистка и рециркуляция воды
-  Дистанционное управление, Автономность, Ощущение безопасности
-  Возобновляемая энергия, Высокотехнологичная система очистки воды, Встроенные датчики

Целевая аудитория 

## Генная фабрика



Комплекс лабораторного оборудования и компьютеров, предназначенных для анализа и манипулирования ДНК. Генная фабрика позволяет проводить медленное секвенирование ДНК и другие подобные операции с генами

-  Работа с данными, Производство, Научное устройство
-  Анализ данных, Подключение проводными к машине
-  Обработка больших данных, Встроенный ИИ, Генетическая модификация

Целевая аудитория 



# THE RESULTS OF THE PROJECT CAN BE HELPFUL DURING FORESIGHT RESEARCH PROJECTS

## Scenario modeling

- The use of science fiction to create diverse and creative scenarios for the future.
- Identifying ways to achieve desired outcomes or prevent undesirable scenarios ("reverse forecasting").

## Wild cards analysis

- A map of predictions from science fiction to identify possible wild cards.
- Assessing risks and opportunities to prepare for unexpected events.

## Prototyping future products and technologies

- Visualization and description of technologies as a source of ideas for development.
- Forecasting the social, economic and political impact of potential technologies.

## Test-driving policy initiatives

- Identifying potential ethical dilemmas and developing strategies to resolve them.
- Finding new approaches to addressing ethical and other challenges by covering a wider range of possible future scenarios.

*Cards of products and technology can be used during events*

## Expert interviews

- Discussion of technology prospects, taking into account science fiction forecasts.
- Stimulation of new ideas and identification of hidden opportunities and risks.

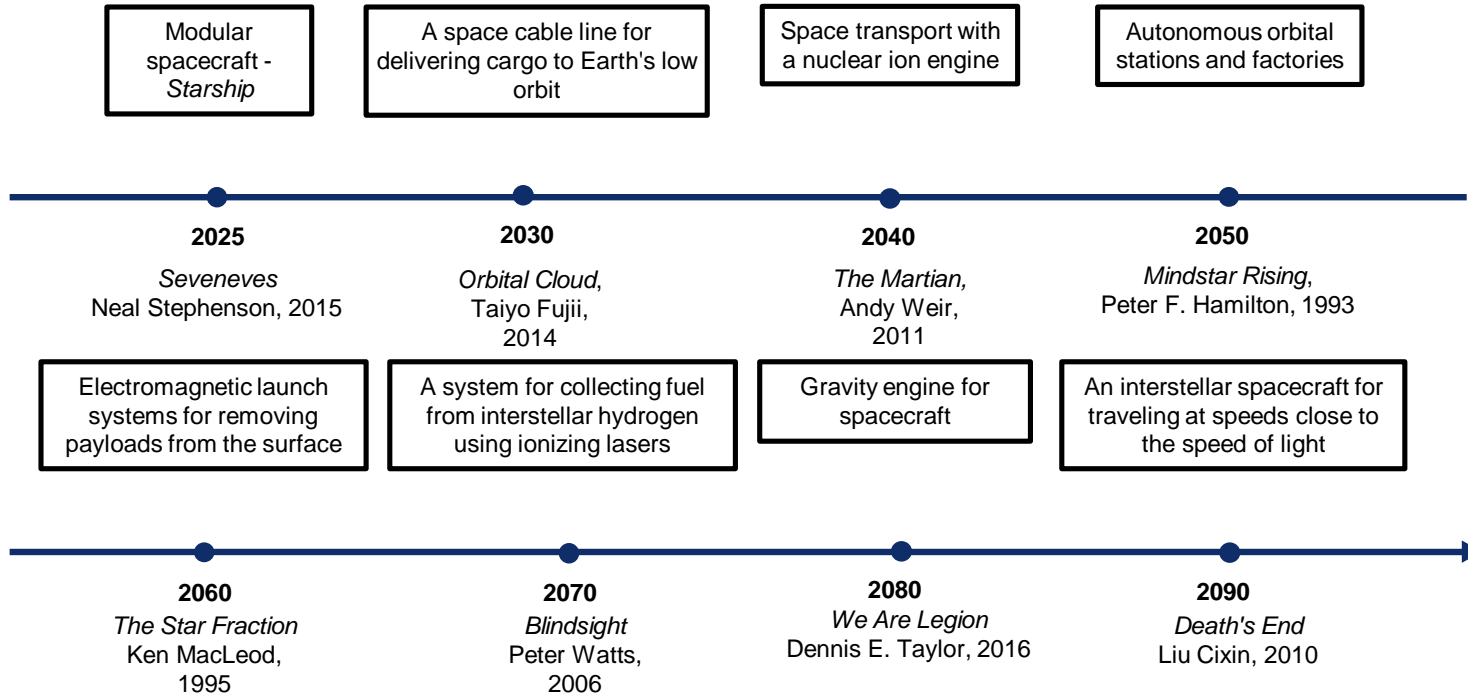
## Foresight workshops

- Helping to identify trends and market needs.
- Creating a shared vision of the industry's future.

*In addition to its use in foresight, science fiction has significant potential in educational initiatives. For example, the science fiction prototyping method is used in British business schools to develop creative thinking in entrepreneurship courses, and in the National University of Taiwan to increase students' interest in science and technology that promotes business innovation.*



# AN EXPERIMENTAL TIMELINE OF THE FUTURE OF SPACE EXPLORATION BASED ON SCIENCE FICTION CONCEPTS



# CONCEPT OF PRODUCTS TIMELINE (BIOCOMPUTER)

A biocomputer is a computer system in which computational processes are performed by biomolecules, cells, or tissues, rather than (just) by semiconductors. A key advantage of such systems is energy efficiency  
 The unique energy efficiency of biocomputers is possible because their architecture is aligned with the operating principles of the human brain - a decentralized system in which memory and computation are inseparable.

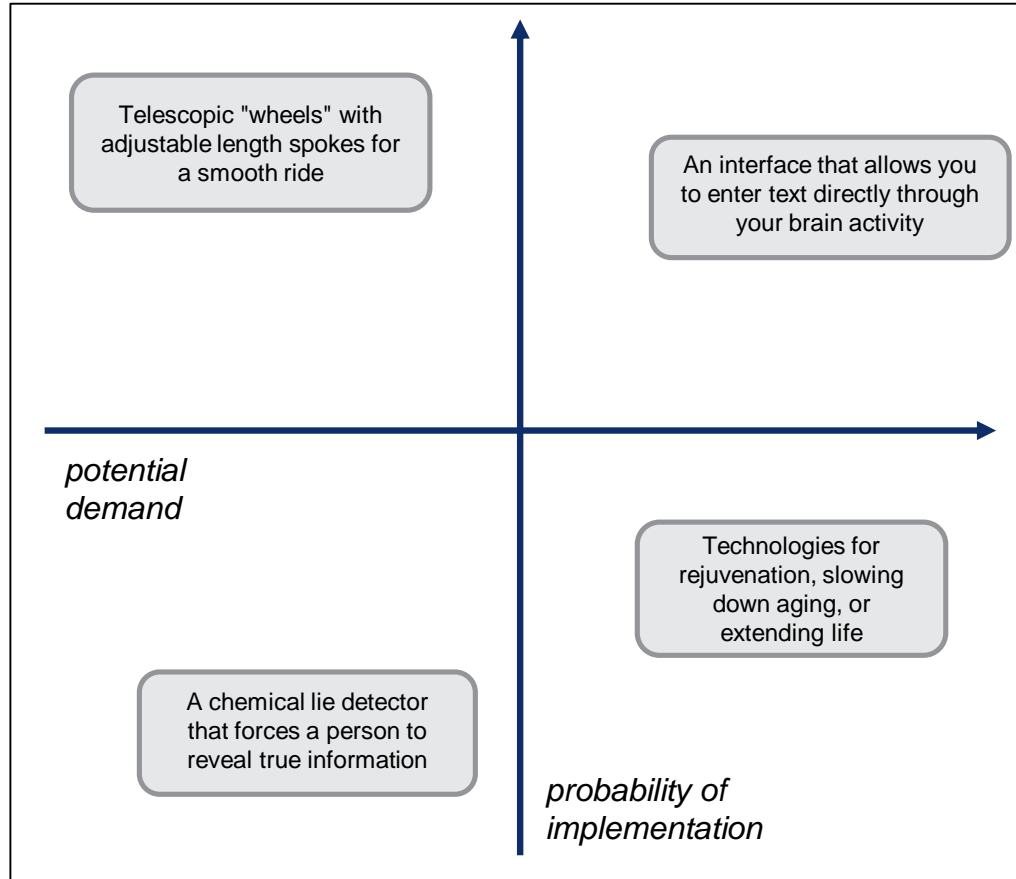
<i>Existing prototype</i>	<i>Description</i>	<i>Science fiction analogue</i>
Microsoft / UW DNA Storage	A system that encodes digital data into synthetic DNA molecules, providing ultra-high density and long-term stability for archival ("cold") data storage.	<b>Coraline</b> from White Queen. The key idea is to use a biological substrate (synthetic protein matrix) as a fundamentally new and highly efficient medium for data processing and storage.
FinalSpark Neuroplatform	A bioprocessor that uses living human brain organoids for computation, demonstrating a colossal (up to a million times) reduction in energy consumption compared to silicon chips.	<b>Bioprocessors</b> from Mindstar Rising. The initial stage of this concept, where biological components act as specialized coprocessors (for memory or data processing), complementing traditional systems.
Cortical Labs DishBrain / CL1	A system in which neurons from human brain cells are integrated with a silicon chip. This hybrid learned to play the video game Pong, demonstrating that biological neural networks can be used to solve targeted problems.	The <b>biocomputer</b> from the novel Blindsight represents the most basic form of this idea — a biological processor capable of performing calculations but devoid of consciousness or subjective experience.
Physarum Wires	Technology that uses the living slime mold Physarum polycephalum to create self-healing, adaptive biological circuits capable of transmitting data.	A <b>self-healing bioorganic computer</b> from Children of Ruin. A direct, real-world analogue of a decentralized, adaptive, and self-healing computing network built from living organisms.





## EXAMPLE OF A FORECAST MAP FOR FORESIGHT WORKSHOPS

31



Using such maps can help participants in foresight sessions identify the most **promising areas** for investment and research

Segmenting forecasts helps identify which technologies require **immediate attention** and which require support and development

Similar tools can also be useful for building **scenarios** (e.g., all forecasts are realized versus only those with a high probability of realization are realized)

Concepts from science fiction can **enrich the range** of possible futures being considered

## Potential research articles

- Visions of Tomorrow: Exploring Future **Scenarios** in Contemporary Science Fiction
- Science Fiction as **Wild Cards** Identification Tool: Examining Possible Disruptive Futures
- Mapping Change and Continuity in the **Technological Landscape** of the Future through the Lens of Science Fiction



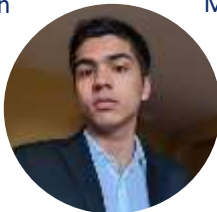
Olesia Maibakh



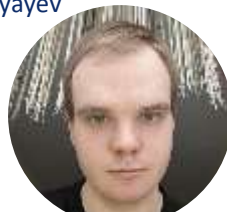
Maksim Dedyayev



Danil Yatzkin



Sukhayl Niyazov



Denis Popov

## How we can work together?

- Create a product implementation markup for science fiction products
- Try to describe the technical characteristics of each product in your specialty
- Conduct a foresight workshop using Interactive product card games
- Participate in writing an article dedicated to science fiction as a tool for predicting of the future

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**THANK YOU FOR YOUR ATTENTION**

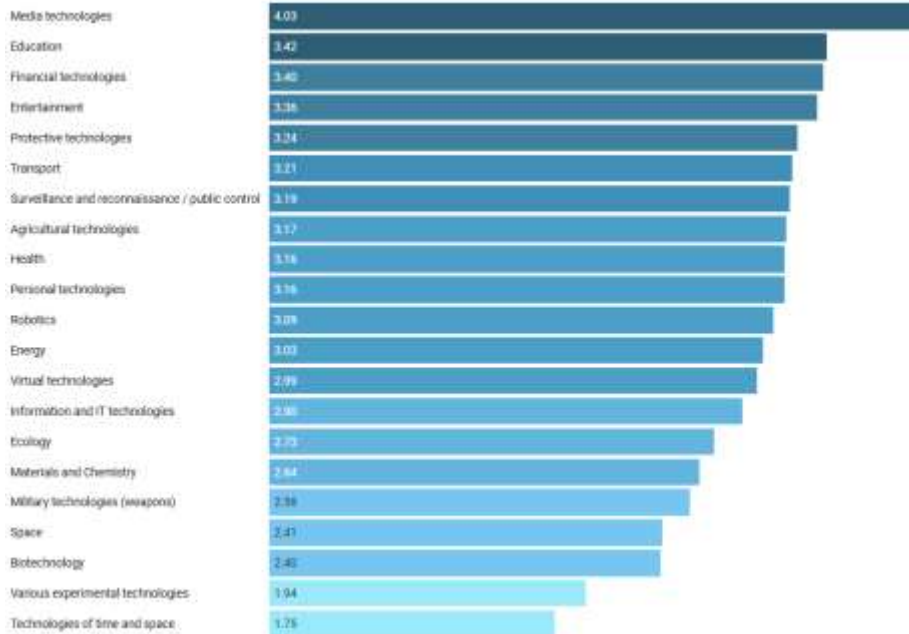
# APPENDIX



## TOP-6 NEEDS – DISTRIBUTION

Needs	Count	Percentage
Waging war with advanced or autonomous weapons	68	5.04%
Moving individuals quickly on or near Earth	50	3.71%
Manipulating biological and genetic code	47	3.48%
Delegating background work and information triage to AI	46	3.41%
Enhancing or augmenting physical abilities	46	3.41%
Performing complex physical tasks with remote or modular robotics	42	3.11%

# DISTRIBUTION OF SCIENCE FICTION PRODUCTS BY CLASS AND REALIZABILITY



**Media technologies** (4.03): This category leads with the highest realizability score, reflecting the rapid and wide adoption of new media platforms, digital communication, and immersive content technologies in contemporary society

**Education & Financial technologies** (3.42–3.40): Both sectors have a strong foundation in deployable innovations—online learning, fintech, and e-payment solutions—demonstrating that science fiction predictions in these domains are often converted into real products and services

**Entertainment, Protective technologies, Transport** (3.36–3.21): These practical domains (e.g., advanced gaming, protective gear, efficient vehicles) consistently score high, indicating strong links between fictional innovations and technological advances on the market

**Surveillance/reconnaissance, Agricultural, Health, Personal technologies, Robotics, Energy** (3.17–3.09): Predictions in security, agriculture, healthcare, personal devices, robotics, and energy transition fall into the moderate range, reflecting steady progress but ongoing technical or regulatory hurdles. These sectors often transform speculative ideas into scalable technologies over time

**Practical, information-based and human-centric domains** top the realizability ranking, highlighting where science fiction has been most predictive of real technological change

**Physical science breakthroughs, radical experimentation, and fundamental transformations** (space, time, matter) stay largely in the realm of speculative fiction, underlining the gap between imagination and technological maturity



## POSITIVE

Information & IT Technologies and Personal Technologies stand out for the highest share of positive influence (above 40–50%). This indicates consistent optimism in science fiction regarding the social and economic benefits of digitalization, connectivity, and personalization. Healthcare and Transport Technologies also show a considerable proportion of positive sentiment, reinforcing their perceived value in improving quality of life and mobility

## MIXED

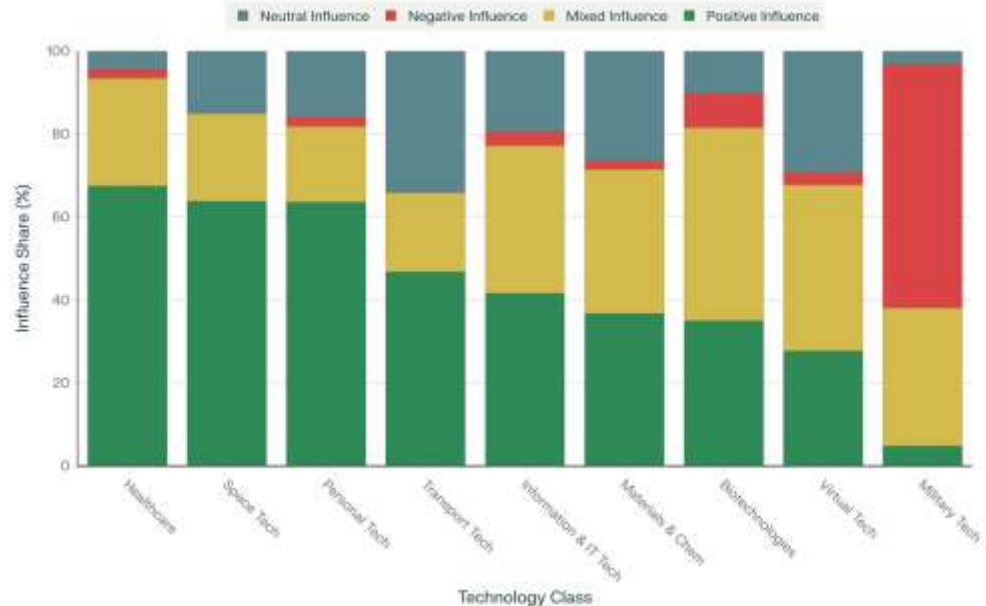
Biotechnologies, Defense, and Military Technologies present dominant mixed influence segments, signaling author ambivalence. These fields are often portrayed with both great promise and significant risk, reflecting debates around genetics, security, and ethical dilemmas. Materials & Chemistry also edge towards mixed influence, emphasizing dual-use or controversial applications

## NEGATIVE

Military, Defense, and (to a lesser degree) Space Technologies exhibit the greatest levels of negative influence, mirroring science fiction's caution about unintended consequences, weaponization, and existential threats. These technologies are frequently linked to dystopian scenarios, control or surveillance, and loss of autonomy

## NEUTRAL

Several classes, notably Space Technologies and Virtual Technologies, feature notable neutral segments. This may reflect narrative uncertainty, technological immaturity, or ambiguous societal impact, leaving room for varied interpretations in literature



## CONCLUSIONS

Technology classes with predominantly positive influence (IT, Personal, Healthcare) are prime candidates for public investment and societal support  
Fields dominated by mixed or negative influence (Biotech, Military, Defense) highlight ethical complexity and the need for regulatory caution—innovative but controversial  
Neutral classes (Virtual, Space) suggest domains with unresolved narratives, signaling opportunity for future research or cultural exploration  
This multi-tiered influence chart enables quick scanning for both opportunity and risk across speculative technology domains, offering valuable guidance for strategic foresight, innovation policy, and science communication



# VIII. MARKET AREAS PROFILE: VOLUME, FEASIBILITY, SENTIMENT AND REALISM

## VOLUME (NUMBER OF TECHNOLOGIES)

Interactive Data Platforms (106) and Autonomous Weaponry (104) dominate the landscape, reflecting strong narrative focus on data ecosystems and futuristic defense  
Mass Transit (54) and Entertainment (43) occupy mid-tier positions, indicating steady but secondary attention

## SENTIMENT (% POSITIVE INFLUENCE)

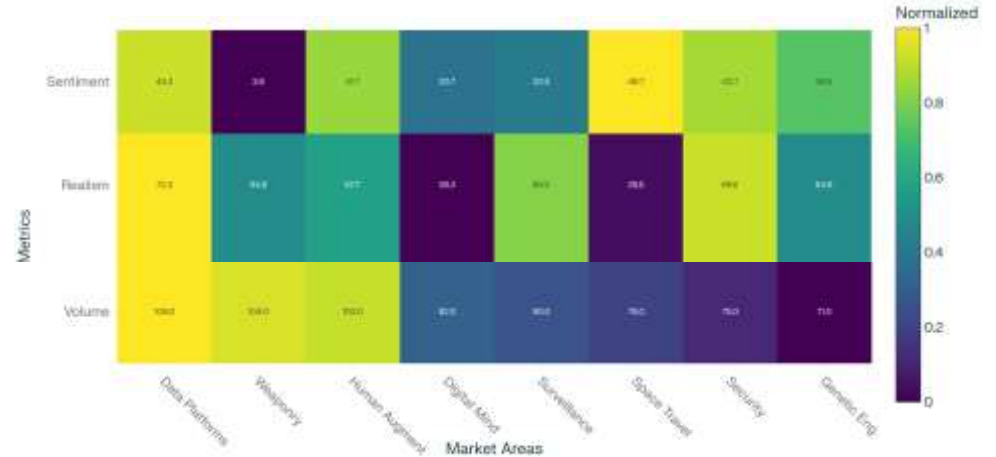
Interactive Data Platforms (45.3%) and Personal Security (50.7%) maintain the highest positive outlook, suggesting narrative optimism around connectivity and protection

Autonomous Weaponry shows mixed sentiment (25.9% positive), reflecting ethical concerns in speculative depictions

## PREDICTED REALISM (% REALISTIC PREDICTIONS)

Personal Security (50.7%) and Surveillance and Detection (42.5%) lead in realism, reflecting mature technologies already entering deployment

Digital Consciousness (3.7%) and Interplanetary Travel (3.8%) register minimal realism, indicating significant developmental gaps





Generated by Seadream



<b>Technology name</b>	Memory editing
<b>Brief description of the conception</b>	Advanced neurobiotechnological systems enabling precise memory editing, including suppression, enhancement, and implantation. Applications include transgenerational transmission of ancestral knowledge, emotional modulation of traumatic memories, and accelerated skill acquisition
<b>Text</b>	<i>Sweep of Stars</i>
<b>Author</b>	Maurice Broaddus
<b>Year of publication</b>	2022
<b>Class</b>	Biotechnology, Information and IT technologies

<b>Subclass</b>	External methods of improving the qualities of a living being (tableting), Cybernetics/Implantation, Memory modification technologies
<b>Target audience</b>	Government, Scientific organizations
<b>Type of social influence</b>	Mixed
<b>Forecast type</b>	Hypothetical
<b>Primary market area</b>	Digital Consciousness and Mind Services
<b>Needs</b>	Recording, editing, or erasing memories on demand



## EXAMPLES OF NOTABLE TECHNOLOGIES: FORENSIC SKETCH ARTIST

40



Generated by Seadream

<b>Technology name</b>	Forensic Sketch Artist
<b>Brief description of the conception</b>	A collaborative process where a sensitive psychically extracts visual memories (faces, locations) from a subject's mind, and a forensic sketch artist then uses this information to create accurate sketches for identification or investigation
<b>Text</b>	<i>Rosewater</i>
<b>Author</b>	Tade Thompson
<b>Year of publication</b>	2016
<b>Class</b>	Information and IT technologies
<b>Subclass</b>	Data storage and processing systems / data management
<b>Target audience</b>	Government, Enterprises / businesses
<b>Type of social influence</b>	Positive
<b>Forecast type</b>	Hypothetical
<b>Primary market area</b>	AI for Automation and Delegation
<b>Needs</b>	Automating large-scale information gathering and surveillance

## Medium-term future (2030–2040)

<i>Existing prototype</i>	<i>Description</i>	<i>Science fiction analogue</i>
Organoid clusters as AI accelerators	Large-scale networks of brain organoids used as extremely energy-efficient coprocessors in data centers, especially to accelerate machine learning tasks and achieve lower power consumption	Bioprocessors from Mindstar Rising. Evolution of current prototypes into commercially viable implants or modules that add parallel computing power and memory to the main system.
Hybrid bio-silicon SoCs (systems-on-chips)	Single chips that directly integrate living neural cultures with electronic circuits, enabling the creation of advanced neuroprosthetics and brain-computer interfaces (BCIs) capable of pre-processing signals on the device itself.	"Wet tech" from the novel Cosmonaut Keep. This concept perfectly describes the nature of such hybrid systems—partly organic, powerful, but inherently difficult to program or analyze using traditional digital methods.
Self-healing bioconductors	Practical implementation of technologies similar to Physarum wires in fields such as soft robotics or aerospace to create adaptive wiring and fault-tolerant sensor networks capable of self-healing.	The bioorganic computer from Children of Ruin. The application of self-healing biological networks in complex engineering systems marks the transition from the laboratory to practical use.

## Long-term future (2040+)

<i>Existing prototype</i>	<i>Description</i>	<i>Science fiction analogue</i>
Evolving "Living Clouds"	Decentralized global networks of interconnected organelles with their own metabolism, capable of self-organization, continuous learning, and optimization of computational loads without human intervention.	A biocomputer from Blindsight. The ultimate realization of this idea is a single computing substrate (similar to the brain or the cloud) capable of running multiple parallel streams of thought or even fully intelligent, independent cores.
Cognitive symbionts	Advanced implants that seamlessly fuse human neural tissue with a computing device, providing radically expanded memory, on-demand cognitive enhancement, and true synthesis of human and machine thinking.	Nanocommunication from Blackfish City: While the novel focuses on the human-animal bond, the underlying technology illustrates the potential of symbiotic, shared consciousness. It also points to the central threat of this era: the risk of information, memories, or trauma spreading like a biological virus through these interconnected systems.

# FEATURES OF USING THE COLLECTED DATABASE IN FORESIGHT

These categories are being developed:

- **Functionality:** can be applied in the goal tree method to build a hierarchy of technology functions; can help determine how well technologies align with social priorities.
- **User experience:** useful in simulation games and scenarios, identifying technologies that are promising for users, and can help create recommendations for improving interfaces and functionality.
- **Realistic assessment:** Applicable to expert methods such as Delphi to assess the significance and likelihood of implementing forecasts.
- **Target audience:** Applicable in civil panels and focus groups, it helps identify the needs of target groups by adapting developments to social requests.
- **Relevant implemented product:** Can be used in benchmarking and scenario forecasting to compare with existing technologies and develop strategies for future technologies.
- **Joker status:** useful for scenario predictions, helping to account for technologies with low probability but high impact in preparation for sudden changes.

