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Trend Radar for the Food Industry

Design | Implementation | Maintenance

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1. Management Summary

The German food industry, consisting of around 6,000 enterprises and generating an annual turnover of €218 billion, is a vital component of the national economy. With over 637,000 employees, the sector mainly consists of small and medium-sized enterprises. Despite its economic importance, the industry faces challenges such as declining investment in research and development, increasing global competition, and changing consumer preferences. These pressures require the adoption of advanced innovation management practices to maintain competitiveness and adaptability.

Trend radars, which originated in the early 2000s, have become essential tools within foresight processes. They offer a framework for monitoring emerging trends, analysing weak signals, and guiding strategic decision-making. Since then, trend radars have transformed into multidimensional instruments applicable across various industries. They incorporate key foresight methodologies, including environmental scanning, trend analysis, and scenario planning, to provide organisations with insights into future developments.

The foresight process starts with environmental scanning, which systematically identifies external factors such as technological advancements and shifts in consumer behaviour. These inputs contribute to the trend radar, which visualises trends categorised by maturity, impact, and relevance. The design of the radar facilitates the prioritisation of trends, encourages stakeholder engagement, and supports strategic discussions. Scenario planning complements this analysis by exploring potential future trajectories, enabling organisations to prepare for uncertainties and disruptions.

In the food industry, trend radars address sector-specific complexities, including prolonged product development cycles and diverse consumer demands. They support the monitoring of technological advancements such as AI-powered food analytics and novel protein sources, alongside sustainability initiatives like food waste reduction and regenerative agriculture. Thus, these tools provide a mechanism for identifying opportunities and mitigating risks in an increasingly volatile environment.

Several case studies demonstrate the effectiveness of trend radars. For example, *MILK.Food* in Germany developed a Future Food Trend Radar that encompasses trends in food, kitchen, production, and packaging. Similarly, the Futures Platform radar in Finland emphasises sustainable agrifood systems, highlighting trends such as cultured meat, precision agriculture, and the locavore movement. These examples illustrate the usefulness of trend radars in guiding innovation and strategy development.

Designing an effective trend radar requires clearly articulating its purpose and scope. Metrics such as maturity levels and domain-specific segments provide a framework for evaluating trends, while visual design elements enhance accessibility and usability. Furthermore, ethical considerations must underpin the radar's development to ensure its responsible application.

Maintaining a trend radar requires ongoing data collection, systematic monitoring, and frequent updates. Automation, especially in data analysis and visualisation, boosts efficiency, while collaborative platforms enhance stakeholder engagement. Regular reporting cycles and scenario planning further strengthen the radar's value as a decision-support tool.

In conclusion, trend radars represent a scientifically robust approach to foresight and strategic planning within the food industry. Integrating data-driven methodologies and ethical practices enables organisations to address complexity, anticipate change, and enhance innovation capabilities. This ensures the industry remains competitive and responsive to an increasingly dynamic global landscape.

2. Introduction

The German food industry is a significant sector of the nation's economy. It comprises approximately 6,000 companies that generate an annual turnover of 218 billion euros. With a workforce of 637,000 individuals, it is Germany's fourth-largest industrial sector. The sector is characterised by a predominance of small and medium-sized enterprises (SMEs), constituting 90 per cent of the industry. The sector's export ratio of 35 per cent underscores its role in Germany's global trade relations (German Bundestag, 2023).

To maintain and enhance this position, the industry must continually innovate its products, services, and processes. Although the German food industry identifies as innovative, it acknowledges that there is still room for improvement (Bundesvereinigung der Deutschen Ernährungsindustrie, 2020). This assessment underscores the relevance of effective innovation management, particularly anticipating and efficiently addressing future consumer needs.

2.1 Background on the German Food Industry

The innovation performance of the German food industry, as measured by corporate investment in research and development (R&D), positions it in the upper midfield compared to its European counterparts. In 2017, the sector invested 320 million Euros in R&D, securing fourth place after France, the United Kingdom, and the Netherlands. The share of R&D investment among German food companies, at 0.16 per cent of production output, aligns closely with the EU average of 0.22 per cent (Eurostat BERD, 2017).

However, recent trends indicate challenges. While innovation expenditures across the German economy have risen steadily since 2009, the food industry has struggled to keep pace, experiencing a significant **reduction in innovation** spending. Furthermore, the proportion of food companies engaged in continuous R&D has fallen from approximately nine per cent in 2010 to seven per cent in 2023, in contrast to the overall German cross-sector average of eleven to 13 per cent over the same period (ZEW, 2011 and ZEW, 2023).

These statistics highlight a need for the German food industry to revitalise its approach to innovation. The sector must adapt to changing market dynamics, consumer preferences, and technological advancements to maintain its competitive edge.

2.2 Importance of Innovation Management

Innovation management in the food industry is essential, given the sector's developments, relevance, and future challenges. It can be conceptualised as a multi-stage process encompassing needs and validating developed product, service, or process innovations.

The innovation management process begins with recognising consumer needs as part of the **foresight** process. Traditionally, this involved preparing for the changing future by identifying and describing **megatrends**. Megatrends outline discernible directions of change and foreseeable alterations to the existing system. It assumes a **linear development** trajectory, wherein organisations can ascertain what needs to be done, what can be achieved, and what would be desirable results based on these trends.

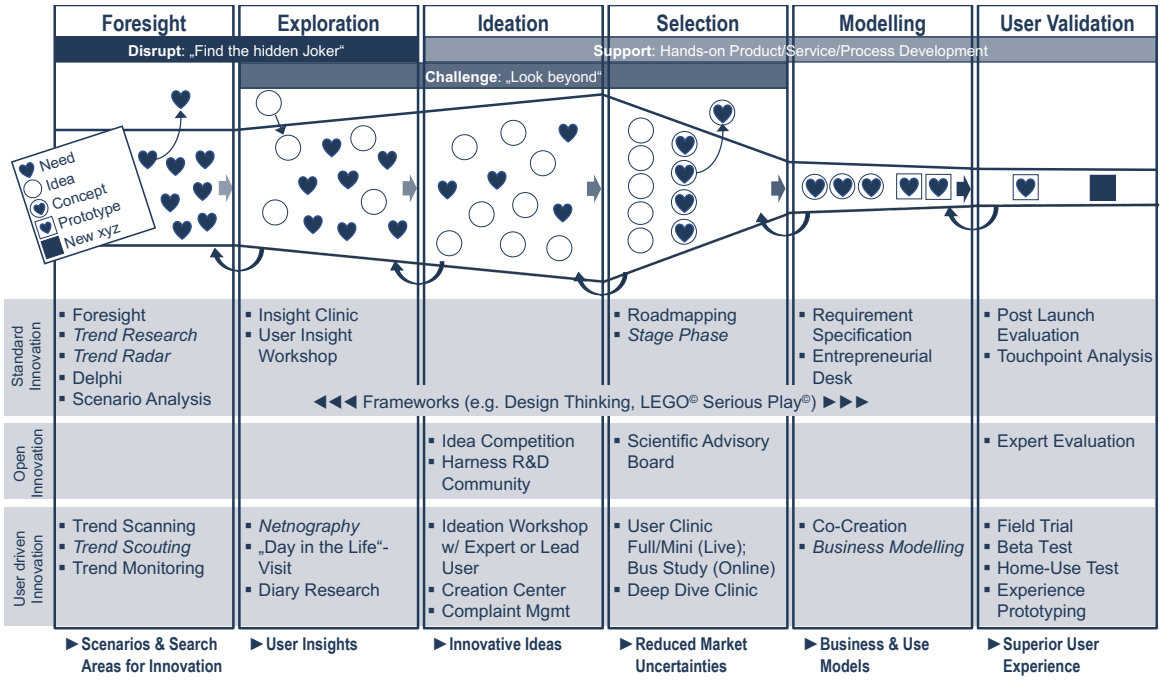

Fig. 1 - (Linear) Innovation Management Framework (Jacobsen, 2025)

However, recent years have witnessed developments that challenge this linear perspective:

- Disruptive technologies: The emergence and adoption of new technologies have transformed industries, often in unforeseen ways. Christensen et al. (2015) emphasise how disruptive innovations fundamentally change market structures and competitive dynamics.
- Supply chain disruptions: Global events like the COVID-19 pandemic have revealed vulnerabilities in supply chain models. Hobbs (2020) discusses how the pandemic has accelerated the need for more resilient and flexible food supply chains.
- Sustainability and climate change: Growing awareness and urgency regarding environmental issues have transformed consumer preferences. Poore and Nemecek (2018) illustrate the considerable environmental impact of food systems and the necessity for sustainable innovations.
- Changing consumer needs: Evolving lifestyles, demographics, and values have resulted in fast changes in consumer demands. Asioli et al. (2017) investigate how consumer preferences for clean-label foods drive innovation in the food industry.

These selected developments highlight that the food industry operates in a 'post-normal' era where **changes are no longer linear** or easily predictable. This new reality demands novel approaches to innovation management and foresight.

2.3 Purpose and Scope of the Working Paper

In light of the challenges and opportunities confronting the German food industry, this paper aims to guide designing, implementing, and maintaining a **trend radar** as part of a **foresight process**. The trend radar, a tool for identifying and visualising weak signals and emerging trends, is one approach to addressing innovation management, especially foresight.

This paper's primary purpose is to equip personnel working at network associations (‘cluster managements’) of the German food industry with the knowledge and tools necessary to use trend radars in their foresight processes. As these individuals typically have limited experience with foresight and trend radars, the paper will provide theoretical foundations and practical applications of this tool.

Furthermore, the paper aims at a secondary audience: employees of member companies who work at the management level and in specialised roles such as research and development, product development, marketing, and management.

Accordingly, the scope of this **paper** encompasses **six key areas**:

1. **Theoretical Framework**: This chapter provides a background on how trend radars fit into the foresight process. It explores the history of trend radars, their goals, and their application in foresight work. Establishing this theoretical foundation ensures all stakeholders understand the rationale behind implementing a trend radar and its benefits. Rohrbeck et al. (2015) provide an overview of (corporate) foresight practices that inform this chapter.

2. **Case Studies**: This chapter presents four short examples of trend radars from the food sector. These case studies highlight the benefits of implementing a trend radar to persuade management-level employees of its value.

3. **Design Guide**: This chapter provides a step-by-step guide to designing a trend radar. It includes detailed instructions on - for example, defining segments and designing maturity levels - ensuring that the trend radar is tailored to the needs of the German food industry. Rohrbeck and Kum's (2018) work on corporate foresight maturity models informs this chapter.

4. **Implementation Guide**: This chapter offers practical guidance on implementing a trend radar. It includes reflecting on data acquisition methods, particularly weak signals. To ensure the trend radar provides actionable insights, data quality is emphasised. Saritas and Smith (2011) provide valuable insights into weak signal analysis, which are incorporated into this chapter.

5. **Maintenance Strategies**: This chapter suggests methods for maintaining the trend radar with minimal manual input. It explores automation opportunities to ensure its ongoing accuracy. Kayser and Blind's (2017) work on using text mining for foresight informs about automation possibilities.

6. **Recommendations:** Finally, the paper summarises the findings from the previous chapters to provide an actionable roadmap for realising a trend radar. It primarily addresses the design, implementation and maintenance of trend radars in various steps and outlines the specific requirements.

By covering these areas, the paper aims to provide a resource that bridges the gap between theoretical understanding and practical application of trend radars in the context of the German food industry.

The adoption of trend radars as part of the foresight process can offer several **benefits** to the German food industry:

- **Early identification of consumer needs**: By systematically scanning the environment for weak signals and emerging trends, companies can anticipate shifts in consumer preferences before they become mainstream.
- **Competitive intelligence**: Trend radars can help identify potential new competitors, including those from adjacent industries and start-ups with disruptive business models.
- **Enhanced adaptability**: By better understanding potential future scenarios, companies can create more flexible strategies and operational models.
- **Strategic opportunity identification**: Trend radars can reveal areas of potential growth or innovation that may otherwise be missed.
- **Enhanced decision-making**: Trend radars offer a structured method for analysing future trends, facilitating more informed and proactive decision-making across all levels of an organisation.

In conclusion, this paper supports the German food industry by providing the tools and knowledge necessary to navigate an increasingly complex and rapidly changing business environment. By adopting and effectively utilising trend radars, the industry can enhance its innovation capabilities, maintain its competitive edge, and continue to play a crucial role in Germany's economic success.

The following chapters will explore each aspect of trend radars in greater depth, providing theoretical insights and practical guidance. This approach aims to facilitate the wider adoption and effective use of trend radars in the German food industry.

3. Theoretical Framework

3.1 Foresight Process in Innovation Management

The foresight process is vital in innovation management, particularly within the food industry. It is a systematic, participatory process of **gathering future intelligence** and building a long-term vision to **inform present-day decisions** and mobilise collective actions (Georghiou et al., 2008). In innovation management, foresight is a strategic tool for anticipating future trends, challenges, and opportunities, thus informing decision-making processes and guiding innovation efforts.

A **foresight process** typically encompasses several key stages:

- Scoping: Defining the foresight activity's focus, objectives, and timeframe.
- Environmental scanning: Systematically exploring and analysing factors that could influence future developments.
- Visioning: Developing desirable future scenarios.
- Planning and implementation: Translating foresight insights into actionable strategies.

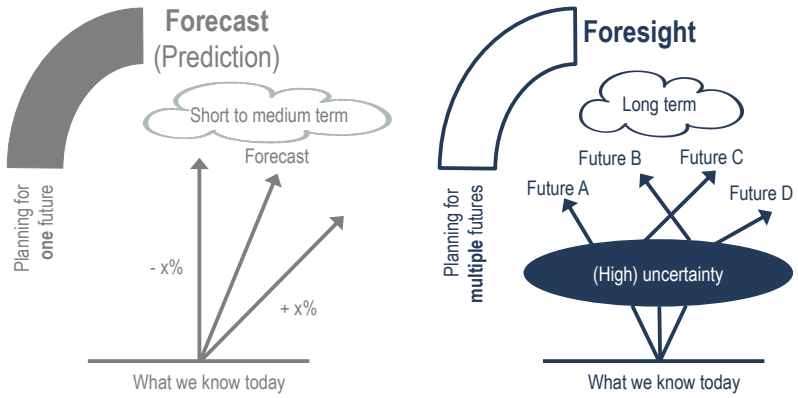

Fig. 2 - Forecast vs. Foresight (based on: https://futurestation.ro/future-preparedness-through-foresight/)

In the food industry context, foresight processes are valuable due to the sector's susceptibility to rapid changes in consumer preferences, technological advancements, and regulatory landscapes. For example, the rise of plant-based proteins, concerns about food sustainability, and the impact of digitalisation (including AI) on food production and distribution are all areas where foresight can provide insights (Bigliardi and Galati, 2013).

However, traditional foresight approaches, which often rely heavily on linear trend extrapolation (which is fore**cast,** not fore**sight**), have faced challenges in recent years. The increasing complexity of global systems led to more frequent occurrences of **'wild cards'** or **'black swan'** events - low probability, high-impact incidents (disruptions) that can dramatically alter future trajectories (Taleb, 2007). The COVID-19 pandemic exemplifies this, significantly disrupting food supply chains and changing consumer behaviours in ways that were difficult to anticipate using traditional foresight methods (Hobbs, 2020).

This recognition has shifted towards more adaptive and resilient foresight approaches. Methods such as **scenario planning**, which examines multiple possible futures rather than trying to predict a single outcome, have become more prominent (Amer et al., 2013). Additionally, there is a growing emphasis on identifying and analysing **weak signals** - early indicators of potential future changes (Hiltunen, 2008).

3.2 History and Evolution of Trend Radars

Trend radars emerged to address the need for more visual and intuitive tools to represent complex foresight data. Although their origins are difficult to determine, they gained prominence in the early 2000s, especially within the technology sector.

One of the earliest documented uses of trend radars was by *Deutsche Telekom* in 2004. The company employed trend radars as part of its technology foresight efforts, **visualising emerging technologies and their potential impact** on the telecommunications industry (Rohrbeck et al., 2006). This early adoption demonstrated the ability of trend radars to present complex, multidimensional data in a format accessible to technical experts and non-specialist stakeholders.

Over time, trend radar applications expanded beyond the technology sector. Retail companies like *Zalando* and *AutoScout24* began using them to track consumer behaviour and market trends. In the logistics and mobility sectors, companies such as *BMW*, *DHL*, and *Deutsche Bahn* adopted trend radars to anticipate shifts in transportation and supply chain dynamics (Gausemeier et al., 2009).

The evolution of trend radars has been characterised by several significant developments:

- Increased sophistication: Early trend radars were simple, often concentrating on a single dimension, such as time horizon. Modern trend radars integrate **multiple dimensions**, including potential impact, certainty, and relevance to specific business units (Rohrbeck, 2010).
- Integration with data analytics: As big data and advanced analytics capabilities have become more accessible, trend radars have integrated these technologies. This integration allows for more data-driven insights and **real-time trend updates** (Mühlroth and Grottke, 2018).
- Customisation and interactivity: Many organisations develop customised trend radar tools to meet their needs. **Interactive digital** versions have also become prevalent, enabling users to explore trends more deeply (Battistella and De Toni, 2011).
- Incorporation of weak signals: Modern trend radars recognise the limitations of focusing solely on trends and incorporate the concept of **weak signals**, which are early indicators of potentially significant future changes (Hiltunen, 2008).

Despite these advancements, the use of trend radars in the food industry is relatively limited, with few documented or publicly accessible cases. This gap presents both a challenge and an opportunity for the German food industry to adapt and innovate in its foresight practices.

3.3 Goals and Applications of Trend Radars in Foresight Work

Trend radars serve multiple **purposes** within the context of foresight. Their primary goals include:

- **Visualisation of complex data**: Trend radars clearly and visually represent multiple trends and their relationships, making complex foresight data more accessible and understandable (Rohrbeck and Kum, 2018).
- Prioritisation of trends: By **categorising** trends according to factors such as time horizon, potential impact, and relevance to specific business areas, trend radars assist in prioritising their efforts and resources (Vecchiato, 2012).
- Facilitation of strategic discussions: The trend radars' visual nature facilitates strategic discussions among stakeholders, fostering a shared understanding of potential future developments (Rohrbeck and Gemünden, 2011).
- **Early warning system**: By integrating weak signals and emerging trends, trend radars can function as early warning systems, notifying organisations of potentially disruptive changes (Ansoff, 1975).

- Trend evolution tracking: Over time, trend radars serve to monitor the evolution of trends, offering insights into the accuracy of past foresight efforts and supporting future foresight work (Battistella and De Toni, 2011).

Fig. 3 - The Role of Trend Radars in the Foresight Process

In the context of **foresight**, trend radars find application in various stages of the **process**:

- **Environmental scanning**: Trend radars can be employed to organise and display the outcomes of environmental scanning activities, offering an overview of the factors influencing the future landscape (Choo, 2001).
- **Trend analysis**: The visual format enables comparison and analysis of trends, aiding in identifying patterns and interactions among trends (Rohrbeck and Schwarz, 2013).
- **Scenario development**: Trend radars enhance the development of future scenarios by emphasising key drivers of change and potential disruptive factors (Amer et al., 2013).
- **Strategy formulation**: By offering an overview of future trends and their potential impacts, trend radars can inform the strategy formulation processes (Vecchiato, 2012).
- **Communication** of foresight results: Trend radars' visual aspects of trend radars make them effective for conveying foresight results to diverse stakeholders, including those lacking specialist knowledge (Rohrbeck and Gemünden, 2011).

In the specific context of the German food industry, **trend radars** could be **valuable** in several areas:

- Anticipating shifts in **consumer preferences**: By monitoring subtle signals and emerging trends in consumer behaviour, trend radars help food companies anticipate and prepare for changes in dietary preferences, sustainability concerns, and attitudes towards food technology (Bigliardi and Galati, 2013).
- Monitoring **technological developments**: Trend radars track advancements in food production technologies, packaging innovations, and digital technologies (including AI) that could impact the food value chain (Santeramo et al., 2018).
- **Supply chain resilience**: By integrating geopolitical, environmental, and economic trends, trend radars may bolster efforts to strengthen the resilience of food supply chains (Hobbs, 2020).
- Innovation pipeline management: Trend radars guide R&D initiatives by emphasising areas of potential future demand and technological opportunity (Bigliardi and Galati, 2013).

While trend radars have potential advantages in the food industry, their implementation necessitates consideration of the industry's specific characteristics. Factors such as the lengthy lead times often associated with food product development, the challenges of global food supply chains, and the varied nature of consumer food preferences must be considered when implementing trend radars in this context.

Furthermore, it is vital to recognise that **trend radars** are not standalone solutions but **should be integrated into broader foresight and innovation management processes**. They should be used with other foresight tools and methodologies, and their insights should be critically assessed.

As the German food industry faces increasing pressure to innovate and adapt to rapidly changing market conditions, adopting advanced foresight tools such as trend radars could be crucial in maintaining and enhancing its competitive position. However, successful implementation will require technical expertise and a shift in organisational culture towards more forward-looking and adaptive approaches to innovation management.

4. Trend Radar in the Food Industry

This chapter presents three case studies of trend radar implementation in the food industry. These examples illustrate the practical application and benefits of trend radars in anticipating future developments and guiding strategic decision-making.

4.1 Case 1: MILK.Food's Future Food Radar (Germany)

MILK.Food, a German food agency, has created a detailed Future Food Trend Radar that examines various facets of the food industry, such as food, kitchen, production, and packaging. The radar is also accessible via the principal author's website (www.danielanthes.com/foodtrends/).

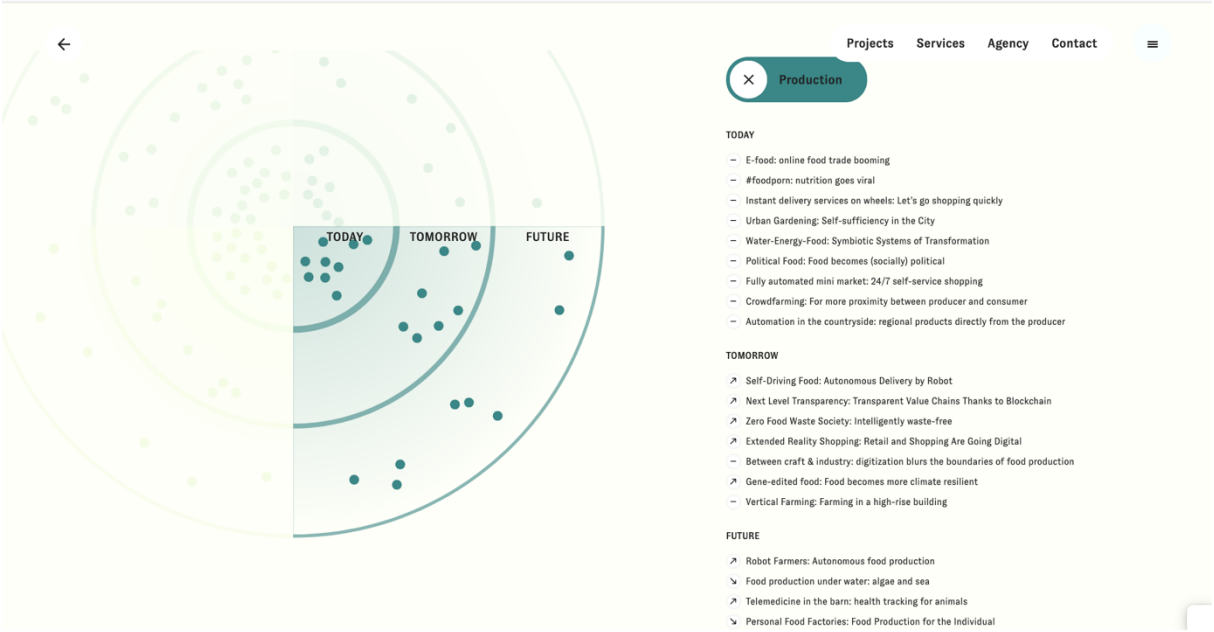

Fig. 4 - Future Food Trend Radar (Source: www.milk-food.de/en/agency/trends/)

Methodology - *MILK.Food's* trend radar is organised into four categories (food, kitchen, production, and packaging), each comprising several specific trends. Although the radar does not explicitly indicate time horizons, it presents trends that suggest differing levels of current relevance (“today”) and future potential (“tomorrow”; “future”).

Key Findings - The trend radar identifies numerous trends across its categories, like:

1. Food Trends
- Regional Food: Emphasising locally sourced products
- Zero Waste: Focusing on reducing food waste
- Plant-based Food: Shift towards plant-based alternatives
- Precision Food: Hyper-personalised nutrition based on DNA

2. Kitchen Trends
- Home Kitchen: The kitchen as the centre of the home
- Smartness Everywhere: Integration of smart technologies in kitchens
- Robot Kitchen: Full automation of kitchen processes

3. Production Trends
- Vertical Farming: Urban agriculture in high-rise buildings
- Gene-edited Food: Enhancing food resilience to climate change
- Predictive Food Analytics: Using AI for food development and taste prediction

4. Packaging Trends
- Compostable Materials: Development of biodegradable packaging
- Reuse Systems: Implementation of reusable packaging in various sectors
- Digitalisation: Use of QR codes and RFID for improved recycling and tracking

Impact and Outcomes - While specific outcomes for *MILK.Food* respectively its customers are not detailed, the nature of their trend radar suggests several potential impacts:

- Industry Guidance: The radar is a resource for food industry professionals who want to understand future trends.
- Innovation Inspiration: The trends can inspire the development of new products and business strategies.
- Sustainability Focus: Numerous trends align with sustainability objectives, impacting industry practices.

4.2 Case 2: Mondelez International's State of Snacking Radar

Mondelez International, a multinational food company, developed a Snacking Trend Radar as part of its State of Snacking report. The radar was likely created using the *itonics Food & Beverage Innovation Software* (www.itonics-innovation.com/food-and-drink-industry).

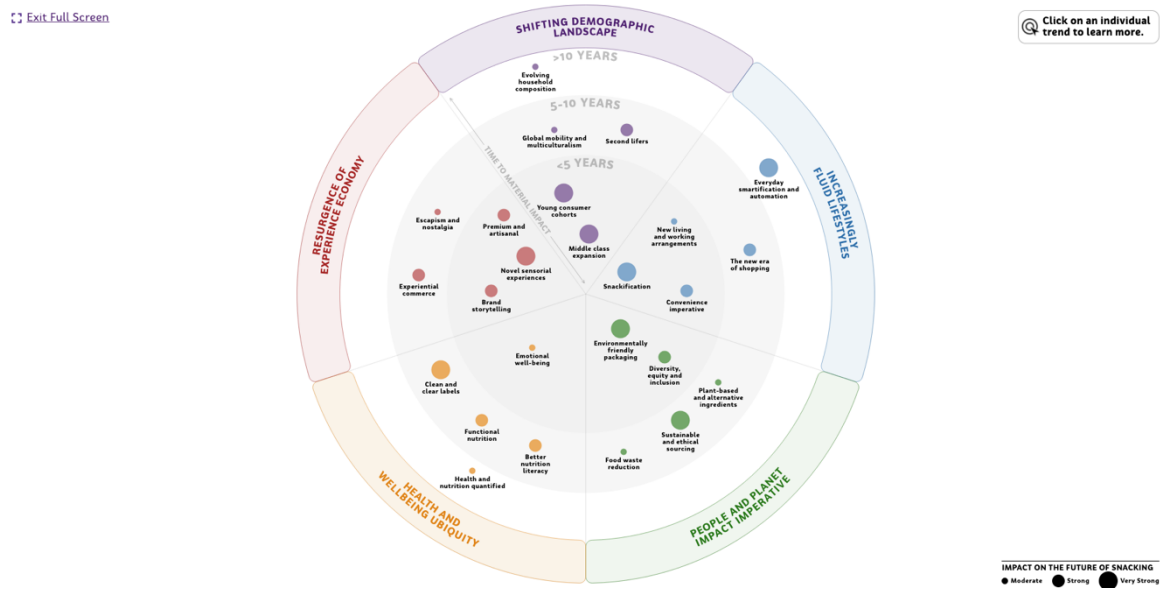

Fig. 5 - International State of Snacking (Source: www.mondelezinternational.com/stateofsnacking/snacking-trend-radar/)

Methodology - *Mondelez's* radar is visually depicted as a circular diagram with three concentric rings that represent different time horizons: Now (up to five years), Next (five to ten years), and Future (more than ten years). The radar is divided into five categories: Shifting Demographic Landscape, Increasingly Fluid Lifestyles, People and Planet Impact Imperative, Health and Wellbeing Ubiquity and Resurgence of Experience Economy.

Key Findings - The trend radar identifies several trends across its categories:

1. Shifting Demographic Landscape
- Middle-Class Expansion (Now): Rapid economic growth in Asia and Africa contributes to the expansion of the global middle class and significantly boosts consumption
- Second Lifers (Next): As the global population ages, mature consumers are gaining prominence in the global consumer market
- Evolving Household Composition (Future): Global household compositions are changing, influenced by several demographic, economic, and social factors

2. Increasingly Fluid Lifestyles
- Snackification (Now): The growing practice of 'snackifying' regular meals is increasing demand for more balanced snacks that serve as adequate nutrition in convenient formats
- New Era of Shopping (Next): Rapid technological advancement is changing the retail landscape and enhancing shopping by enabling instant purchases anytime and anywhere
- Everyday Smartification (Future): Smart technologies and (semi-)autonomous devices are increasingly entering households

3. People and Planet Impact Imperative
- Environmentally Friendly Packaging (Now): An increasing consumer and regulatory focus on environmental issues drives the transition to more sustainable packaging
- Sustainable and Ethical Sourcing (Next): Sustainable and ethical sourcing has become a critical consideration for many consumers in their food choices, driven by a growing awareness of the environmental and social impact of agriculture and food manufacturing

4. Health and Wellbeing Ubiquity
- Emotional Well-being (Now): Mental wellness is becoming increasingly significant in the fast-paced modern world.
- Clean and Clear Labels (Next): Driven by the growing focus on better nutrition and sustainability, clean and clear label claims resonate with consumers, positively impacting demand
- Health & Nutrition quantified (Future): Advancements in sensing and wearable technologies, image recognition and artificial intelligence converge to enable next-level health and nutrition monitoring with highly personalised nutrition guidance.

5. Resurgence of Experience Economy
- Novel Sensorial Experiences (Now): As modern consumers increasingly prioritise experiences over possessions, food and snacks offer exciting and affordable experiential adventures into taste and flavour
- Experiential Commerce (Next): Experiential commerce aims to elevate shoppers' journey through engaging, immersive, and interactive experiences that span across retail channels and platforms

Impact and Outcomes - While specific outcomes are not detailed, the trend radar likely influences *Mondelez's* strategies in several ways:

- Product Development: Informing the creation of new snack products aligned with identified trends
- Marketing Strategies: Guiding communication methods to align with changing consumer preferences
- Sustainability Initiatives: Encouraging efforts to enhance the environmental impact of snack production and packaging.

4.3 Case 3: FIBRES Future of Food Radar (Finland)

FIBRES, a trend radar platform provider, developed a trend radar focusing on food trends. The trend radar has been populated with a proprietary AI-generated data set featuring food-related trends and technologies.

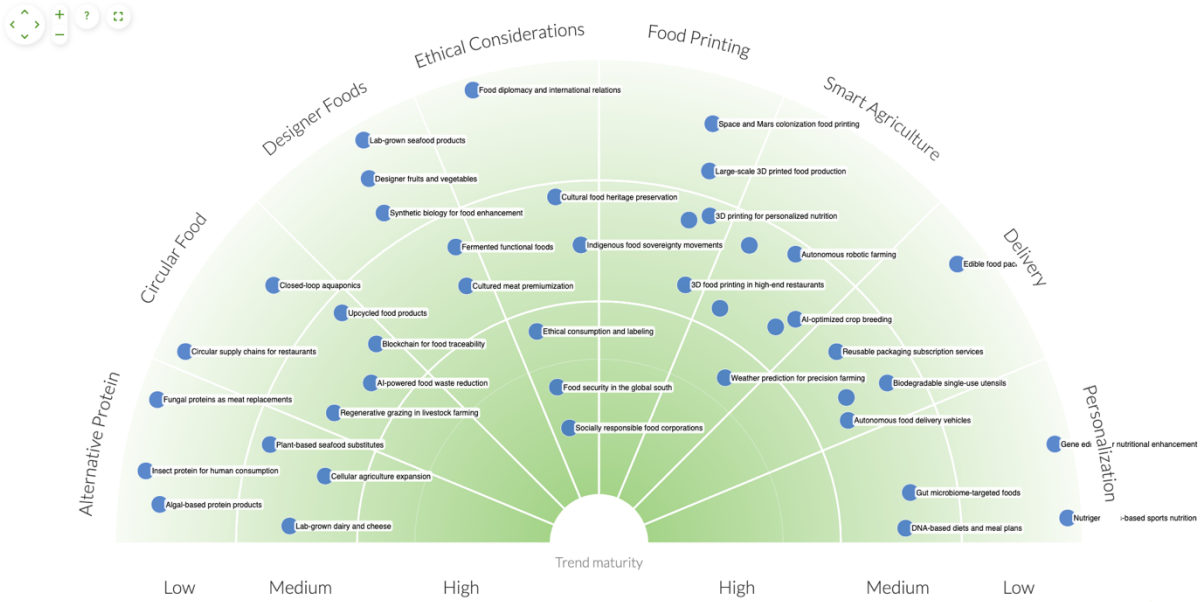

Fig. 6 - Future of Food (Source: www.fibresonline.com/ai-data-sets/food)

Methodology - *FIBRES's* trend radar is organised into eight categories, each comprising specific trends. Although the radar does not explicitly indicate time horizons, it applies a trend maturity level that suggests differing levels of current relevance ("high") and future potential ("medium"; "low").

Key Findings - The trend radar identifies numerous significant trends across its categories:

1. Alternative Protein
- Plant-based Seafood Substitutes (Next): As concerns over ocean sustainability and the health benefits of seafood grow, plant-based alternatives to fish and shellfish are emerging as a promising solution.
- Fungal Proteins as Meat Replacements (Future): Fungal proteins are emerging as a promising alternative to animal-based meat products. They offer a sustainable and nutritious option for consumers seeking plant-based alternatives.

2. Food Printing
- 3D Printing for Personalised Nutrition (Next): 3D printing technology is advancing rapidly and being applied to new domains, including food production.
- Large-scale 3D Printed Food Production (Future): 3D printed food is moving beyond novelty applications and small-scale experiments to large-scale industrial production.

3. Personalisation
- Gut Microbiome-targeted Food (Next): The growing understanding of the gut microbiome's crucial role in human health drives a new wave of personalised nutrition.
- Gene-editing for Nutritional Enhancement (Future): Gene editing techniques like CRISPR are being used to enhance the nutritional content of food crops and livestock.

4. Delivery
- Biodegradable Single-use Utensils (Next): Disposable utensils and food packaging have long been convenient for consumers and businesses, but their environmental impact has become a growing concern.
- Edible Food Packs (Future): An approach that could revolutionise food packaging and consumption.

Impact and Outcomes - While specific outcomes for *FIBRES* respectively its customers are not detailed, the nature of their trend radar suggests several potential impacts:

- Industry Guidance: The radar is a valuable resource for food industry professionals who want to understand future trends.
- Innovation Inspiration: The trends can inspire the development of new products and business strategies.
- Technology Focus: Numerous identified trends align with technological improvement objectives, impacting industry practices.

4.4 Case 4: Future Platform Transformative Food Systems and Paradigms Radar (Finland)

Futures Platform, another foresight tool provider, has developed a trend radar focused on Sustainable Agrifood Systems.

Fig. 7 - Transformative Food Systems and Paradigms (Source: www.futuresplatform.com/foresight-radar/sustainable-agrifood-systems)

Methodology - The *Futures Platform* radar is an interactive digital tool that positions trends based on their estimated time of impact (2024 to 2052), grouping them into 16 thematic clusters (categories). The radar has been produced using research from *Inayatullah* and *Milojevic*.

Key Findings - The radar identifies several significant trends related to sustainable agrifood systems:

1. Alternative Proteins:
- Cultured Meat: Lab-grown meat products
- Insect-based Food: Increased use of insects as a protein source

2. Technological Advancements:
- Vertical Farming: High-tech, space-efficient urban agriculture
- Precision Agriculture: Use of AI and IoT in farming

3. Sustainability Practices:
- Regenerative Agriculture: Farming practices that reverse climate change
- Food Waste Reduction: Technologies and practices to minimise food waste

4. Consumer Behaviour:
- Plant-based Diets: Increasing popularity of vegetarian and vegan options
- Locavore Movement: Preference for locally sourced food

Impact and Outcomes - While specific outcomes for users of the *Futures Platform* radar are not detailed, potential impacts include:

- Strategic Planning: Assisting agrifood businesses in long-term strategy development
- Risk Management: Helping identify potential disruptions to current business models
- Innovation Opportunities: Highlighting areas for potential product or service development in sustainable agrifood systems

4.5 Further Food-related Radars

In addition to the trend radars presented above, some more specific trend radars in the context of food are openly accessible. These include:

- "Trends Shaping Western European Agrifood Systems of the Future" authored by German *Leibnitz Institute of Vegetables and Ornamental Crops* and the *Freie Universität Berlin* with its School of Business and Economics and its Department Master Futures Studies (www.mdpi.com/2071-1050/14/21/13976).
- "Die stärksten Trends und Trendkonzepte in der Topgastronomie" (The strongest trends and trend concepts in top gastronomy) authored by German *zukunftsInstitut* (www.zukunftsinstitut.de/ zulunftsthemen/trendradar-gastronomie).

These cases illustrate how trend radars are utilised in the food industry to anticipate future developments, guide innovation, and inform strategic decision-making. Each example highlights a distinct approach to trend categorisation and visualisation, emphasising the versatility of trend radars as foresight tools.

5. Designing a Trend Radar

Effective trend radar design is vital for its success as a foresight tool. This chapter provides a guide on designing a trend radar suited to the needs of the German food industry.

5.1 Defining the Purpose and Scope

Before exploring the specifics of trend radar design, clearly defining its purpose and scope is crucial. For the German food industry, the **main objectives** of a trend radar potentially include (Rohrbeck and Kum, 2018):

- Anticipation of (technological) innovations in food processing
- Early identification of emerging consumer trends
- Monitoring of regulatory changes affecting the industry

The **scope** should be clearly defined in terms of:

- Time horizon (e.g., short-term: 0-2 years, medium-term: 2-5 years, long-term: 5-10 years)
- Geographical focus (e.g., German market, European Union, global)
- Categories, such as industry segments (e.g., dairy, meat alternatives, functional foods)

Clearly defining these elements will guide the subsequent design decisions and ensure that the trend radar remains relevant to the industry's needs.

5.2 Defining Metrics

The metrics used in a trend radar are crucial for its effectiveness. They determine how trends are evaluated, categorised, and visualised. For the German food industry, the following metrics are recommended:

5.2.1 Segments

Segments (or categories) represent the different areas of interest for the industry. Based on the current structure and future challenges of the German food processing industry, the **following segments** are proposed (Bundesvereinigung der Deutschen Ernährungsindustrie, 2020):

- Consumer Preferences
- Technology and Processing
- Ingredients and Nutrition
- Regulatory Environment
- Sustainability and Ethics
- Market Dynamics

These segments cover the industry's main areas of interest and provide a comprehensive view of the factors that could impact its future.

5.2.2 Maturity Levels

Maturity levels indicate the stage of development of a particular trend. For the German food industry, a **four-level maturity scale** is recommended (Golovatchev, Budde and Kellmereit, 2010):

- Emerging (5-10 years from mainstream adoption)
- Growing (3-5 years from mainstream adoption)
- Maturing (1-3 years from mainstream adoption)
- Mainstream (Currently adopted or within 1 year of mainstream adoption)

This scale allows for a balanced view of trend development while remaining simple enough for straightforward interpretation.

5.2.3 Evaluation Criteria

To ensure a comprehensive assessment of each trend, the following **evaluation criteria** are proposed (Vecchiato, 2012):

- Potential Impact: The degree to which the trend could affect the industry (Low, Medium, High)
- Certainty: The likelihood of the trend materialising as anticipated (Low, Medium, High)
- Relevance: The specific relevance of the trend to different subsectors of the German food processing industry (e.g., relevant to dairy, meat processing, bakery, etc.)
- Speed of Change: How quickly the trend is evolving (Slow, Moderate, Rapid)
- Opportunity/Threat: Whether the trend primarily represents an opportunity or a threat to the industry

These criteria provide a multi-dimensional view of each trend, allowing for more informed decision-making.

5.3 Visual Design

The visual design of the trend radar is crucial for its effectiveness as a communication tool. The following **design elements** are recommended (Battistella and De Toni, 2011):

- Circular Layout: A circular layout divided into the six segments identified earlier.
- Concentric Rings: Four concentric rings represent the maturity levels, with emerging trends on the outer ring and mainstream trends in the centre.
- Colour Coding: Different colours for each segment to aid quick visual identification.
- Trend Markers: Each trend should be represented with a circular marker. The size of the marker can indicate the potential impact of the trend.
- Interactive Elements: Interactive elements such as hover-over information boxes for each trend.

5.4 Data Collection and Analysis Framework

A data collection and analysis framework is essential to populate the trend radar with relevant and accurate information. The following approach is suggested (Sitra, 2022; Miller, 2018):

1. Data Sources
- Scientific literature and patents
- Industry reports and white papers
- Consumer surveys and social media sentiment analysis
- Expert interviews and Delphi studies
- Startup and venture capital investment trends
- Regulatory announcements and policy papers

2. Systematic Scanning Process
- Implementation of a scanning schedule (e.g., weekly for news sources, monthly for scientific literature)
- Application of automated tools for initial filtering of large volumes of data
- Employment of a team of analysts for in-depth review and trend identification

3. Trend Evaluation Process
- Development of a standardised evaluation based on the criteria outlined in section 5.2.3
- Implementation of a multi-step evaluation process involving individual analyst assessments followed by group discussions
- Application of quantitative scoring methods to ensure consistency in trend evaluations

4. Weak Signal Detection
- Implementation of a process for capturing and evaluating potential weak signals
- Application of scenario planning techniques to explore the potential implications of weak signals

5.5 Customisation for Different Stakeholders

Considering the diverse target audience for the trend radar, which includes association personnel and employees from member companies at various levels, it is crucial to design the tool with **customisation options**. The following aspects should be kept in mind (Keller, Markmann and von der Gracht, 2015):

- Layered Information: The trend radar is designed with multiple layers of information. The top layer provides a high-level overview suitable for management, while the deeper layers offer a more detailed analysis for R&D and specialist roles.
- Filtering Options: Options are applied to filter trends based on specific criteria (e.g., relevance to particular subsectors, time horizon, potential impact).
- Customisable Views: Users can create custom views of the trend radar based on their specific interests or roles within their organisations.
- Supplementary Reports: Development of detailed reports on specific trends or clusters of trends that can be accessed by users requiring more in-depth information.

5.6 Ethical Considerations

When designing the trend radar, it is crucial to consider ethical implications, especially due to the food industry's direct impact on public health and the environment. The following **ethical guidelines** should be kept in mind (Bovenkerk, 2006):

- Transparency: Transparency about the methodologies used to identify and evaluate trends.
- Bias Mitigation: Implementation of processes to identify and mitigate potential biases in trend selection and evaluation.
- Data Privacy: When using consumer data, strict adherence to data privacy regulations and ethical data use principles.

In conclusion, designing an effective trend radar for the German food industry requires careful consideration of multiple factors, from selecting appropriate metrics to integrating existing systems. By following this design approach, the association can create a powerful tool that enhances the foresight capabilities of the entire industry (Naisbitt, 1984).

6. Implementing a Trend Radar

Implementing a trend radar is a process that requires careful planning and execution. This chapter provides a guide on implementing a trend radar for the German food industry. It includes data collection methods, analysis of weak signals, and critical reflections on data quality and sources.

6.1 Establishing the Implementation Team

The first step in implementing a trend radar is establishing a team responsible for its development and maintenance. This team should be cross-functional, including members with diverse expertise relevant to the food processing industry. Ideally, the team should comprise:

- Data analysts with experience in trend analysis and foresight methodologies
- Industry experts familiar with the German food processing sector
- Technology specialists knowledgeable about food processing innovations
- Consumer behaviour experts
- Regulatory affairs specialists

The team should also include a project manager to oversee the implementation process and ensure alignment with the association's goals. Rohrbeck et al. (2015) emphasise the significance of having a diverse team to capture various perspectives and expertise in foresight activities.

6.2 Data Collection Methods

Effective data collection is crucial for the success of a trend radar. The team should employ various methods to gather comprehensive and diverse data. The following data collection methods are recommended:

6.2.1 Systematic Literature Review

A systematic review of academic and industry literature establishes a foundation for identifying established trends and emerging weak signals. This should encompass:

- Academic journals related to food science, technology, and consumer behaviour
- Industry reports and white papers
- Patent databases
- Government and regulatory body publications

The team should develop a structured approach to the literature review, including defined search terms, inclusion/exclusion criteria, and a system for categorising relevant information. Tranfield et al. (2003) provide a guide on conducting systematic reviews in management research, which can be adapted to the food industry context.

6.2.2 Expert Interviews and Delphi Studies

Engaging with industry experts can provide insights into emerging trends and weak signals. Methods include:

- Semi-structured interviews with industry leaders, academics, and policymakers
- Delphi studies to gather expert consensus on future trends

Linstone and Turoff (2002) offer guidance on conducting Delphi studies, which can be useful for capturing expert opinions on long-term trends in the food industry.

6.2.3 Consumer Surveys and Social Media Analysis

Understanding consumer behaviour and preferences is crucial for the food processing industry. Data collection methods should include:

- Regular consumer surveys to track changing preferences and attitudes
- Social media sentiment analysis to identify emerging consumer trends
- Analysis of online search trends related to food products and dietary habits

Vidal et al. (2015) demonstrate the effectiveness of combining traditional surveys with social media analysis in food trend research, providing a model that could be adapted for the German market.

6.2.4 Start-up and Innovation Ecosystem Monitoring

Observing start-up activities and innovation ecosystems can offer early indicators of disruptive trends. This should include:

- Regular tracking of food tech start-up funding and activities
- Monitoring of innovation challenges and accelerator programs in the food sector
- Attendance at food innovation conferences and trade shows

Mayer (2019) highlights the importance of start-up ecosystem monitoring in identifying emerging food industry trends, offering insights that could be applied to the German context.

6.3 Data Analysis and Trend Identification

Once data is collected, the next step is to analyse it to identify relevant trends and weak signals. The following approaches are recommended:

6.3.1 Text Mining and Natural Language Processing

For large volumes of textual data from literature reviews and social media analysis, **text mining** and **natural language processing techniques** can be utilised to identify emerging themes and trends. Tools such as **topic modelling** can be particularly beneficial in this context. Kayser and Blind (2017) demonstrate the effectiveness of text mining in identifying weak signals for strategic planning within the food industry.

6.3.2 Trend Scoring and Prioritisation

Development of a systematic method for scoring and prioritising identified trends based on criteria such as:

- Potential impact on the industry
- Likelihood of occurrence
- Time horizon
- Relevance to different segments of the food processing industry

Linkov and Moberg (2011) describe a multi-criteria decision analysis approach that can be adapted for this purpose.

6.4 Identifying and Analysing Weak Signals

Weak signals are early indicators of potentially significant future changes. Their identification and analysis require specific approaches:

6.4.1 Defining Weak Signals in the Food Industry Context

Establishment of clear criteria for what constitutes a weak signal in the context of the German food industry. This might include:

- Novel consumer behaviours observed in niche markets
- Emerging food technologies with limited current application

Hiltunen (2008) provides a comprehensive framework for understanding and categorising weak signals, which can be adapted for the food industry.

6.4.2 Weak Signal Detection Techniques

Employment of specific techniques for detecting weak signals, such as:

- Horizon scanning: Systematically survey the external environment for potential changes
- Wild card workshops: Engage experts in imagining low-probability, high-impact events
- Trend extrapolation: Extend current trends to their logical extremes to identify potential disruptions

Saritas and Smith (2011) provide insights into horizon-scanning methodologies applicable to weak signal detection in the food industry.

6.4.3 Weak Signal Monitoring

Once weak signals are identified, implementation of processes to amplify and monitor them is required:

- Development of a weak signal database to track their evolution over time
- Regularly reassessment of weak signals to determine if they are gaining strength or fading
- Application of scenario planning techniques to explore the potential implications of weak signals

Rossel (2012) offers guidance on weak signal amplification techniques that could be adapted for the context of the food processing industry.

6.5 Data Visualisation and Reporting

Effective visualisation and reporting of trend radar data is crucial for its usability. The following approaches should be considered:

6.5.1 Interactive Digital Platform

Development of an interactive digital platform for the trend radar that allows users to:

- Filter trends based on different criteria (e.g., time horizon, industry segment)
- Access to detailed information about each trend
- Visualisation of connections between different trends

Rohrbeck et al. (2015) discuss the benefits of interactive foresight tools in enhancing organisational future preparedness.

6.5.2 Regular Reporting

Establishment of a regular reporting schedule to keep stakeholders informed about trend developments:

- Quarterly trend updates highlighting new and evolving trends
- Annual comprehensive trend reports with in-depth analysis
- Ad-hoc alerts for rapidly emerging trends or weak signals

6.6 Critical Reflection on Data Quality and Sources

Maintaining data quality is crucial for the credibility and effectiveness of the trend radar. The following aspects should be considered:

6.6.1 Data Source Evaluation

Regular evaluation of the quality and reliability of data sources:

- Assessment of the credibility and potential biases of expert contributors
- Evaluation of the representativeness of consumer survey samples
- Consideration of the limitations of social media data in representing broader consumer trends

Flick (2018) provides guidance on assessing the quality of qualitative data sources, which can be applied to the diverse data inputs of the trend radar.

6.6.2 Data Triangulation

Employment of data triangulation techniques to enhance the reliability of trend identifications:

- Cross-verification of trends across multiple data sources
- Application of mixed methods approaches, combining quantitative and qualitative data
- Engagement of multiple team members in data interpretation to mitigate individual biases

Denzin (2017) offers insights into triangulation methods that can be adapted for trend analysis in the food industry.

6.7 Ethical Considerations in Implementation

The implementation of a trend radar raises ethical considerations that must be addressed:

6.7.1 Data Privacy and Consent

Securing that all data collection methods, particularly those involving consumer data, comply with relevant privacy regulations:

- Obtain informed consent for consumer surveys and social media data use
- Anonymisation of data where appropriate to protect individual privacy
- Implementation of robust data security measures to protect sensitive information

The European Union's General Data Protection Regulation (GDPR) provides a framework for ethical data handling that should be adhered to (European Parliament and Council, 2016).

6.7.2 Transparency in Methodology

Maintenance of transparency about the methods used in trend identification and analysis:

- Clear communication of the limitations and potential biases of the trend radar
- Provision of methodology documentation to allow for critical assessment

6.8 Continuous Improvement and Adaptation

The implementation of a trend radar should be viewed as an iterative process with continuous improvement and adaptation:

- Regular review and refinement of data collection and analysis methods
- Application of feedback from users on the utility and usability of the trend radar
- Staying informed about advancements in foresight methodologies and incorporating relevant innovations

Following these implementation guidelines, the association can develop a robust and effective trend radar that provides valuable foresight for the German food industry. The key to success is maintaining a systematic approach while remaining flexible and responsive to the industry's dynamic nature and operating environment.

7. Maintaining the Trend Radar

Maintaining a trend radar ensures its relevance and effectiveness as a foresight tool for the German food industry. This chapter outlines key strategies for efficient updating processes, explores automation possibilities and discusses methods for ensuring the trend radar's continual accuracy.

7.1 Efficient Updating Processes

Maintaining an up-to-date trend radar requires systematically and efficiently updating its content. The following strategies can help streamline this process:

7.1.1 Continuous Monitoring

Implementation of a continuous monitoring system to capture new trends and changes in existing trends:

- Development of a **systematic schedule** for reviewing different data sources
- Application of **automated alerts** for keywords related to identified trends

Rohrbeck (2010) emphasises the importance of continuous environmental scanning in corporate foresight activities, which can be applied to trend radar maintenance.

7.1.2 Regular Review Cycles

Establishment of regular review cycles to assess and update the trend radar:

- Conducting **monthly reviews** to identify new trends and update existing ones
- Execution of quarterly in-depth analyses to reassess trend relevance and positioning
- Implementation of annual reviews to evaluate the overall structure and effectiveness of the trend radar

Vecchiato and Roveda (2010) discuss the importance of regular foresight activities in maintaining organisational preparedness for future changes.

7.1.3 Stakeholder Feedback Integration

Incorporation of feedback from stakeholders to improve the trend radar:

- Establishment of channels for users to provide feedback on trend relevance and accuracy
- Conducting regular surveys of association members to gather insights on emerging trends
- Organisation of workshops with industry experts to validate and refine trend assessments

Rohrbeck and Gemünden (2011) highlight the value of stakeholder engagement in enhancing the quality and relevance of foresight activities.

7.2 Automation Possibilities

Leveraging automation can significantly enhance the efficiency of trend radar maintenance. The following areas offer potential for automation:

7.2.1 Data Collection and Processing

Automation of the collection and initial processing of trend-related data:

- Implementation of **web scraping** tools to gather data from predefined online sources
- Application of **natural language processing** (NLP) algorithms to analyse and categorise textual data
- Development of automated systems for social media monitoring and sentiment analysis

Kayser and Blind (2017) illustrate the effectiveness of text-mining techniques in improving foresight activities. These techniques can be utilised for automated data collection in trend radars.

7.2.2 Trend Identification and Clustering

Employment of machine learning algorithms to assist in trend identification and clustering:

- Application of clustering algorithms to identify emerging patterns in collected data
- Implementation of **topic modelling** techniques to discover latent themes in large text corpora
- Develop **predictive models** to forecast the potential evolution of identified trends

Mühlroth and Grottke (2018) provide insights into the application of machine learning techniques for weak signal detection in corporate foresight, which can be adapted for trend radar maintenance.

7.2.3 Visualisation Updates

Automate the process of updating the visual representation of the trend radar:

- Development of scripts to automatically adjust trend positions based on updated data
- Implementation of dynamic visualisation tools that reflect real-time changes in trend data
- Creation of automated reports highlighting significant changes in the trend landscape

7.2.4 Alert Systems

Implementation of automated alert systems to notify relevant stakeholders of significant changes:

- Set up threshold-based alerts for sudden shifts in trend indicators
- Develop automated email or notification systems for new trend identifications
- Create **personalised alert systems** based on user interests and industry segments

7.3 Adapting to Changing Industry Dynamics

The food industry is subject to rapid changes, necessitating a flexible approach to trend radar maintenance:

7.3.1 Regular Reassessment of Radar Structure

Periodically reassessment of the structure and categories of the trend radar:

- Evaluation of the relevance of existing trend categories annually
- Identification of emerging areas that may require new categories or subcategories
- Adjustment of time horizons and impact scales as industry dynamics evolve

7.3.2 Integration of Emerging Technologies

Continuous integration of emerging technologies into the trend radar maintenance process:

- Exploration of the potential of **artificial intelligence** and machine learning in trend analysis
- Investigation of the use of **big data** analytics for more comprehensive trend identification
- Consideration of the application of **blockchain** technology for enhanced data verification and tracking

7.3.3 Scenario Planning Integration

Integration of scenario planning techniques to enhance the robustness of trend assessments:

- Development of multiple future scenarios based on key uncertainties in the industry
- Evaluation of the relevance and potential impact of trends across different scenarios
- Application of scenario insights to identify potential blind spots in trend monitoring

Amer et al. (2013) provide a comprehensive review of scenario planning techniques, offering insights that can be integrated into trend radar maintenance.

7.4 Knowledge Management and Dissemination

Effective knowledge management and dissemination are crucial for maximising the value of the trend radar:

7.4.1 Knowledge Repository Development

Development of a comprehensive knowledge repository to support trend radar maintenance:

- Creation of a centralised database of trend information, including historical data and analysis
- Implementation of a tagging system for easy retrieval of relevant information

7.4.2 Collaborative Platforms

Implementation of collaborative platforms to facilitate knowledge sharing:

- Development of an internal wiki for sharing insights and analysis related to trends
- Implementation of discussion forums for ongoing dialogue about emerging trends

7.4.3 Communication Strategies

Development of effective communication strategies to disseminate trend radar insights:

- Creation of regular newsletters highlighting key trends and updates
- Organisation of webinars and workshops to present trend radar findings to member companies
- Development of customised reports for different stakeholder groups within the industry

By implementing these maintenance strategies, the German food industry association can ensure its trend radar remains a valuable and trusted foresight tool. Regular updates, automation of key processes, and a focus on relevance and accuracy will help the trend radar adapt to the industry's dynamic nature and continue to provide valuable insights for strategic decision-making.

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