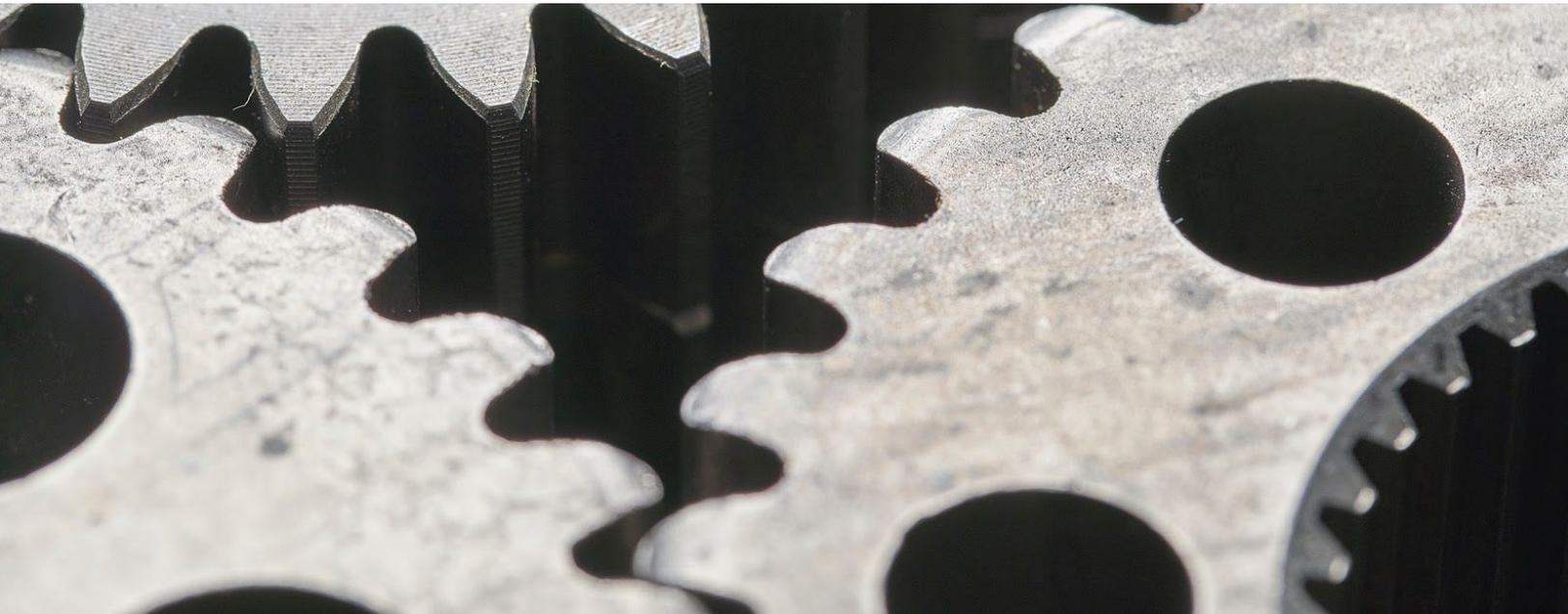




# Futures Wheels as Tools for Elucidating Non-obvious Opportunities and Challenges for Industry Growth

July 31, 2020

Fostering deliberate creative thinking



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In order to be successful, Advancing Solutions for Alternative Proteins requires us to anticipate future consequences that may unexpectedly adversely or positively affect the growth of the industry. If we have insight into not just obvious implications but also secondary, tertiary, or even quaternary effects, we can strategically guide solutions to capitalize on the advantages and avoid the pitfalls.

[Futures wheels](#), sometimes called [implications wheels](#), have been used across a wide variety of fields for guiding futures-oriented thinking and elucidating potential non-obvious consequences of future scenarios — both positive and negative. The history books are riddled with examples of short-sighted strategic thinking where decisions made on the premise of obvious “first-order” consequences ended up leading to adverse downstream implications. Sometimes, a first-order and a second-order implication can counteract and neutralize each other. In other cases, two implications may produce a feed-forward effect, leading to a much more drastic effect than is intuitively obvious.

To develop a comprehensive and robust strategy for catalyzing growth of the alternative protein industry, this complex and dynamic web of interactions needs to be elucidated and planned for. To this end, the Advancing Solutions for Alternative Proteins working group at GFI conducted a futures wheel exercise in December 2019 as part of our conceptual mapping of the industry. This memo will highlight a few of the most noteworthy insights generated from this exercise and provide a set of actionable recommendations for subsequent exercises to solicit novel insights.

## Developing a suitable prompt

The insights garnered from a particular futures wheel will be heavily influenced by the framing of the prompt, and several possible prompts were considered for this exercise.

Positive versus negative framing can affect the predispositions of the participants. For example, prompts can assume a future scenario in which the industry is on a positive growth trajectory or one in which the industry has declined or stagnated, and these can elicit very different modes of creative thinking. Positive prompts are useful for surfacing unanticipated negative consequences or weaknesses that, once elucidated, can be mitigated through strategic planning. Negatively framed prompts may unearth strategies to build in resilience or to identify counterintuitive advantages or opportunities that may arise in a time of crisis for the industry.

Likewise, the timeframe of the selected prompt will affect the degree of certainty of the primary, secondary, and tertiary implications. A widely-acknowledged concept in future-oriented thinking is the notion of an expanding cone of possibility with time. The further we are, temporally, from a hypothetical future scenario, the more uncertainty there is regarding the dynamics that will arise in that future state. Thus, prompts that examine a long time horizon may generate an abundance of creative, blue-sky thinking, but nearer-term prompts may surface insights that are more concrete and actionable.

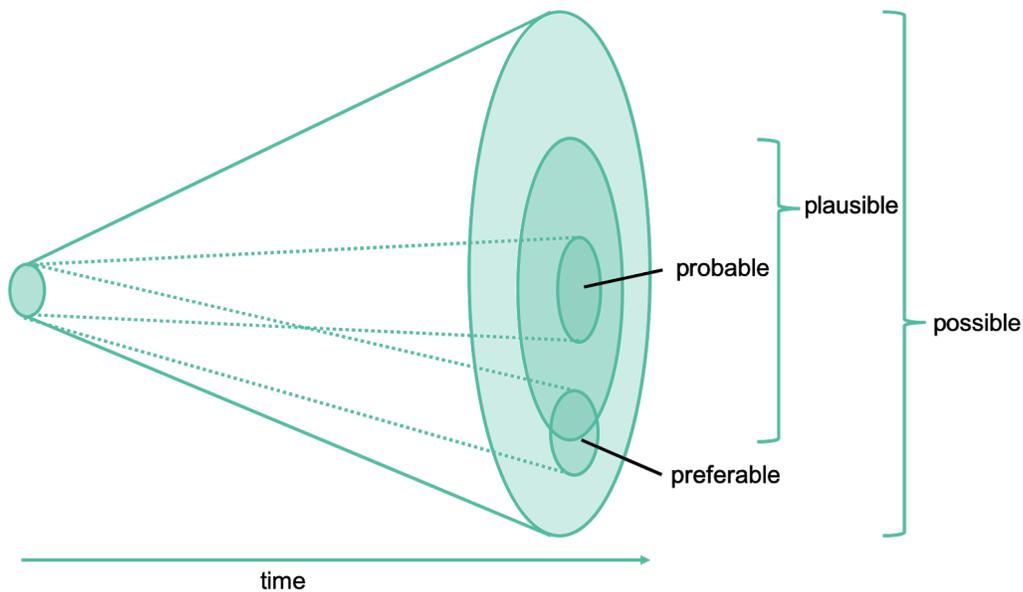


Figure 1. Uncertainty increases as hypothetical scenarios are extended further into the future, but so does the range of plausible and possible outcomes. Early actions can shift the trajectory of the future so substantially that preferred scenarios may become possible, even if they only represent borderline plausibility relative to the current probable trajectory.

Finally, the scope of the prompt is perhaps the most challenging and open-ended decision. Beginning with a very broad scenario as a prompt can generate discrete lines of deep thinking that may merit their own dedicated futures wheels during subsequent exercises. This was our strategy for this iteration: to canvass the industry broadly without being overly prescriptive about the types of implications, with the intention of observing what preliminary insights emerged that may require follow-on iterations to resolve more fully.

With all of these considerations in mind, we selected the following prompt:

**“The year is 2035, and alternative proteins account for 10% of global meat sales.”**

This was chosen as a scenario that is possible yet highly ambitious, residing at the qualitative boundary indicated in Figure 1 between plausible and possible. This level of penetration into the animal protein market would represent a sharp departure from the status quo while still being achievable if the alternative protein industry can maintain a 25% compound annual growth rate. The global, production platform-agnostic scope was chosen to cast a wide net for impacts that may manifest differently across diverse geographies or access different production modalities (and to elucidate tensions or opportunities that may arise as a result of unequal industry growth). And the moderate time horizon (15 years) was selected as a window in which technological advances and evolutions in consumer sentiment are still largely foreseeable, while also allowing sufficient time that it is conceivable that unexpected advances or shifts will have substantially altered the landscape of possibility.

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## Conducting a futures wheel exercise

Futures wheel exercises can be conducted synchronously or asynchronously, or they can utilize a combination of these approaches. Asynchronous exercises can harvest insights from a broader array of stakeholders since scheduling does not constrain participation. However, synchronous participation fosters an environment where diverse perspectives can build upon each other in real time to generate threads of insights that would not necessarily occur to a solo participant. Modern online digital whiteboards are the recommended medium due to ease of adjusting the arrangement of nodes to accommodate new contributions, the legibility and durability of all contributions without the need to transcribe into a permanent and shareable format, and the fact that participants need not be physically co-located.

We utilized a combined approach where six GFI staff members first participated in a 60-minute synchronous session to populate the futures wheel collaboratively. These participants were deliberately chosen to provide a diverse set of perspectives: three were members of the core Advancing Solutions for Alternative Proteins working group, while three additional participants were familiar with but peripheral to the project. They included two people with primarily scientific backgrounds and four people with backgrounds primarily in business, consulting, advising. After this session, these participants were encouraged to contribute additional insights or build upon existing threads asynchronously throughout the week. We used Miro Board software as the medium for collecting ideas.

## Elucidating insights for further exploration

One striking example will be used to illustrate the types of insights that surfaced through this exercise and how future wheels can lead to productive ideation for solutions (if a potential challenge was elucidated) or opportunities to capitalize on synergies (in the case of a potential side-benefit).

Figure 2 shows two distinct lines of thought — one positive and one negative — that emerged from a single primary implication of the scenario where alternative proteins satisfy 10% of global meat, egg, and dairy demand by 2035. Because of this hypothesized rapid pace of disruption of global crop markets, it is likely that there will be sidestreams resulting from the extraction and enrichment of protein from plant crops. These sidestreams will predominantly be starch- and fiber-rich fractions. In fact, anecdotally this is already being observed with recent increases in demand for the protein fraction of crops like mung bean and yellow pea driven by companies like Beyond Meat and JUST, while demand for the residual starch-heavy fraction is unchanged.

On the one hand, this could have negative consequences, some of which only become apparent at the quaternary or quinary level of implications. If the animal feed industry ends up as a major purchaser of the sidestream fraction, then this could provide a new lost-cost feed stream that would ultimately benefit the animal agriculture industry. However, it's possible that this would be

a non-ideal feed source from the standpoint of digestibility and thus might increase gut irritation or inflammation. This, in turn, could incentivize higher use of antibiotics to mitigate the risk of infection or weight loss from this inflammation, which could potentially increase the risk of antibiotic resistance tied to animal agriculture.

On the other hand, these sidestreams could be leveraged as inputs for a number of additional industrial uses — some relevant to the alternative protein industry, such as feedstocks for fermentation, while others are simply parallel applications within the broader bioeconomy.

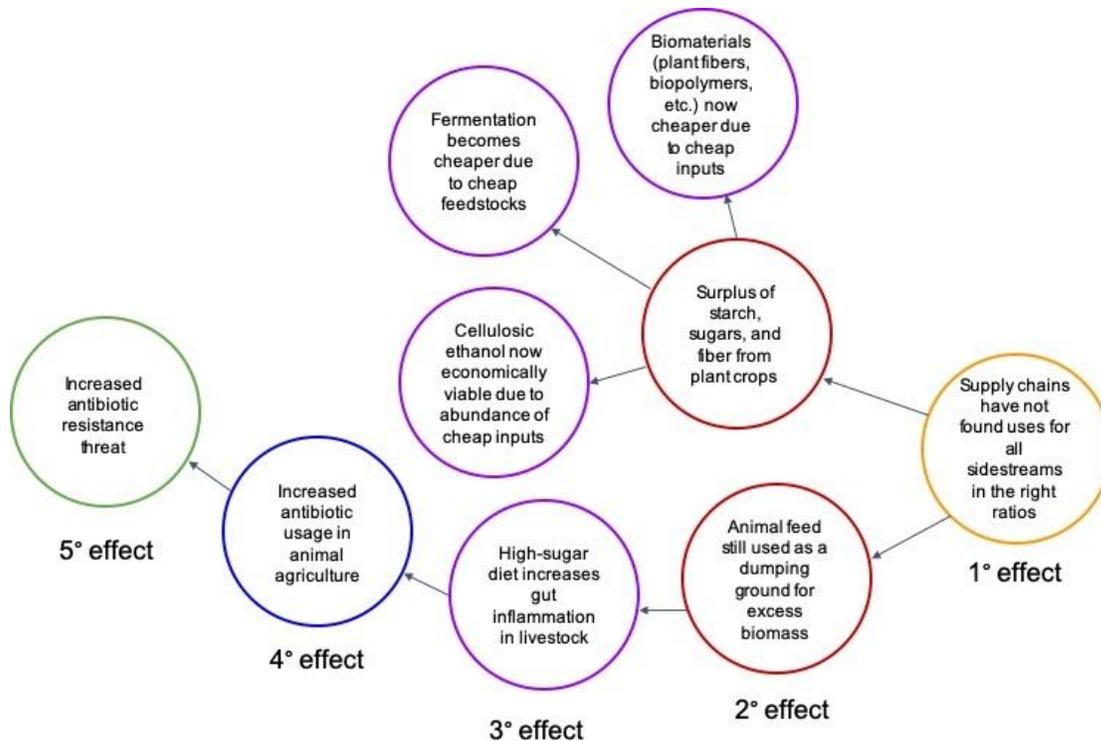


Figure 2. Secondary, tertiary, quaternary, and quinary implications generated from a single primary implication of the futures wheel prompt of alternative proteins achieving 10% global penetration into the meat, egg, and dairy market by 2035.

One actionable take-away from this example pair of insights is that research efforts should be catalyzed immediately to valorize starch- and fiber-rich sidestreams left over from protein enrichment of major plant protein crops. To take it one step further, suitability of the residual fraction for applications like fermentation feedstocks, cellulosic bioenergy feedstocks, and biomaterial synthesis inputs should be explicitly included as a key consideration when screening or breeding specialty crops for their potential as plant protein sources for plant-based meat. Thus, in this case, the solution to the potential risk that these protein crops end up supporting animal agriculture (and potentially even accelerating some of its associated environmental and public health harms) is directly aligned with an opportunity to incentivize plant protein production by identifying high-value uses for the sidestreams that will be generated as plant protein demand increases. If these higher-value markets exist, then plant protein processors will not be

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likely to sell their sidestream fractions to low-value markets like animal feed. It is also possible that sidestream valorization could contribute meaningfully to the overall value of the crop, potentially incentivizing more farmers to transition to growing these crop varieties.

Examples of commercial solutions that specifically address the issue of sidestream valorization are already visible in the market. It is well known, for instance, that soybean meal — and the soy protein concentrates and isolates derived from soybean meal — are sidestreams of soy oil extraction. There are also cases where the carbohydrate-rich sidestream of a protein enrichment process has been valorized and, conversely, cases where the protein fraction is itself the sidestream of an existing commercial process. PURIS, which processes pea protein, has commercialized their [pea starch](#) fraction for applications like animal-free gummy candies. Take Two Foods has launched a [barley milk](#) product from the residual protein and fiber in spent brewer's grains after the yeast have metabolized the sugar content during beer brewing.

Developing and funding early cross-disciplinary research projects and partnerships between researchers working on plant protein processing and those working on feedstocks for biomaterials, fermentation, or bioenergy would accelerate the realization of this value-generating potential. This would improve the attractiveness to growers of novel plant protein crops, increase incentives for new processing capacity to be built, and potentially reduce costs for raw materials for the plant-based meat industry and perhaps for the fermentation industry as well.

At a concrete level, this points toward several opportunities:

- Approach researchers and research funders with an interest in the success of these parallel fields and articulate the projected growth in the abundance of plant protein processing sidestreams as potential feedstocks so that they will take interest in exploring these materials as inputs for their processes.
- Develop a forecasting model for more rigorous projection of total available input and sidestream volumes that will be used to make the conversations above more compelling and specific.
- Support research for further processing of plant protein sidestreams to make them ideal feedstocks for these applications.
- Conduct technical and market research to understand the current limitations of conventional feedstocks.
- Based on an understanding of what further processing is required, develop techno-economic models to determine what capabilities and volumes will be required to achieve performance parity and price parity with current feedstocks.
- Approach industry, governmental, or philanthropic entities to solicit interest in guaranteed offtake agreements, advanced market commitments, or similar mechanisms to incentivize rapid scale-up of plant protein processing such that these break-even volumes are achieved commercially as quickly as possible.

This sidestream example also illustrates that the further removed the implication is, the more uncertainty exists. For instance, it is a near-certainty that, at least in the early stages of a rapid

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increase in demand for plant protein-rich fractions, there will be imbalances in demand across the other fractions. However, the notion that incorporating sidestreams from novel plant protein enrichment into animal feed would result in greater livestock gut inflammation is rather speculative, and the implication that the response to this reaction would be to increase antibiotic usage is even more speculative.

The purpose of this exercise is not to comprehensively or conclusively articulate all possible consequences within a hypothetical future scenario. Rather, the goal is to elucidate possible discrete elements of a future scenario that are either desirable or undesirable and to explicitly consider how current efforts could bias the trajectory toward or away from those elements. Prior to embarking on a specific project (be it a research project or a commercial endeavor), all key underlying assumptions should be assessed and validated through a feasibility study, stakeholder interviews, or preliminary bench or desk research.

## Recommendations for subsequent futures wheel exercises

Given the insights from this exercise, there is value to continuing to conduct similar exercises in the future using different prompts and including more diverse external participants.

Future prompts could include:

- Different time horizons: both shorter and longer.
- Different framing: for example, framed as failure of the conventional meat industry versus success of the alternative protein industry.
- Different scopes: focus on specific regions, product categories, industry stakeholders, funding scenarios, or even discrete events.

Below are a few examples of prompts — some only slightly different from the prompt above, others substantially different — that would likely elucidate novel insights. Some of these entail very specific scenarios generating insights more suitable for outlining a damage control strategy, while others are more open-ended and may generate ideas for long-term research, business development, or policy prioritization. But all of these may be useful for preparing for, accelerating, or mitigating possible future scenarios.

- It's 2035 and the sales volume of the global conventional meat, egg, and dairy market is down 2% from its peak in 2033.
- It's 2025 and plant-based meat is manufactured at a scale of 50 million metric tons per year globally (approximately 15% of total meat production).
- It's 2030 and the U.S. cattle and dairy industry is at 50% of its 2024 peak.
- It's 2040 and alternative proteins comprise 20% of the North American and European meat market but only 5% of the Asia-Pacific, African, and Latin American markets.
- It's 2040 and alternative proteins comprise only 5% of the North American and European meat market but 20% of the Asia-Pacific, African, and Latin American markets.
- The front-runner cultivated meat company fails to raise a Series C round by 2023.

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- A top-five national quick-service restaurant chain decides to discontinue carrying a plant-based burger in 2020.
  - African Swine Fever Virus spreads to North America in 2022.
  - The Department of Defense decides to launch an alternative protein Advanced Manufacturing Institute in 2021 because of national food security concerns.
  - Through a combination of overfishing and ecosystem collapse from pollution and climate change, bluefin tuna go extinct in 2027.

As one can appreciate just by starting to mentally articulate first-order and second-order implications in response to the prompts above, these exercises can inform strategy at multiple levels and can be used to pressure-test new ideas by imagining the implications of either success or failure.

## Opportunities to contribute

GFI plans to conduct similar exercises in the coming months to solicit insights from a diverse array of stakeholders, ranging from academics and entrepreneurs to industry leaders and policymakers. If you're interested in participating in a future exercise, please fill out [this form](#) and we'll be in touch when we have a new virtual session scheduled. If you want to conduct your own futures wheel exercise independently and would like to share your findings with GFI, we welcome your insights! Please use the same form to let us know.

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## About GFI

The Good Food Institute is a global nonprofit building a sustainable, healthy, and just food system. With expertise across the scientific, regulatory, industry, and investment landscape, we are accelerating the transition of the world's food system to alternative proteins, using the power of food innovation and markets.