Charity Entrepreneurship

FEED FORTIFICATION

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RECOMMENDED

Research Report:
Animal Welfare – Feed Fortification (2020 Recommended Idea)

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This is a summary report about fortifying feed for egg-laying hens with optimal levels of calcium, phosphorus, and vitamin D3, a potential intervention for improving animal welfare. In our five-step research process this report corresponds to step four, the drafting of an in-depth, 80-hour report on a potential intervention. All the ideas considered for animal advocacy are listed in this spreadsheet. Other reports on animal welfare can be found on our website.

Thanks to Karolina Sarek, Erik Hausen, and Ali Ladak for reviewing the research, and to Antonia Shann, Nicoleta Faina, Bella Forristal, Patrick Stadler, and Urszula Zarosa for their contributions to this report. We are also grateful to the experts who took the time to offer their thoughts on this research.

For questions about the content of this research please contact Vicky Cox at vicky@charityscience.com. For questions about the research process, charity recommendations, and intervention comparisons please contact Karolina Sarek at karolina@charityscience.com.

Charity Entrepreneurship is a research and training program that incubates multiple high-impact charities annually. Our mission is to cause more effective charities to exist in the world by connecting talented individuals with high-impact intervention opportunities. We achieve this through an extensive research process and through our Incubation Program.

Research Process

Before opening the report, we think it important to introduce our research process. Knowing the principles of the process helps readers understand how we formed our conclusions and enables greater reasoning transparency. It will also clarify the structure of the report.

Our research process incorporates elements that are well established in some fields but uncommon in others. This is partly because of the unique goals of our research (i.e. finding new areas for impactful charities to be launched) and partly because we incorporate lessons and methodologies from other fields of research, primarily global health and medical science. Below is a quick overview of some of the key elements.

Iterative depth: We research the same ideas in multiple rounds of iterative depth. Our goal is to narrow down our option space from a very large number of ideas (often several hundred at the start) to a more workable number for deeper reports. This means we do a quick 20-minute prioritization, a longer 2-hour prioritization, and finally an 80-hour prioritization. Each level of depth looks at fewer ideas than the previous round.

Systematic: The goal of our research is to compare ideas for a possible charity to found. To keep comparisons between different ideas consistent our methodology is uniform across all the different ideas. This results in reports that consider similar factors and questions in a similar way across different interventions, allowing them to be more easily compared. This is commonly used in other charity evaluations and encouraged in other fields.

Cluster approach: Comparing different intervention ideas is complex. We are not confident that a single methodology could narrow down the field, in part due to epistemic modesty. To increase the robustness of our conclusions, we prefer instead to look at ideas using multiple independent methodologies and see which ideas perform well on a number of them (more information here). These methodologies include a cost-effective analysis, expert views, informed consideration, and using a weighted factor model. We explain the merits and disadvantages of each method, as well as how we apply it, in the linked documents. Each methodology is commonly used in most fields of research but they are rarely combined into a single conclusion.

Decision relevant: Our research is highly specialized and focused. We only research topics that are directly related to the endline choice of what charity to found. Sometimes cross-cutting research is needed to allow comparison between different ideas, but all our research aims to be directly useful to getting new charities started. This level of focus on target practical outcomes is rare in the research world, but is necessary to our goal of generating more charity ideas with minimal time spent on non-charity idea related concepts.

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Fortifying chicken feed

Subsidizing feed for farmers in India is the approach we have modeled to improve egg-laying hen welfare. However, we will also consider alternative countries and approaches in the implementation report, and the entrepreneurs should be open-minded to pursuing any combination of these alternatives, or pivoting to them if our best guess doesn't work out. Ultimately, **the endline goal of this intervention is to improve the quality of egg-laying hen feed**.

It is important to note that when deciding on the best approach and country combination for this intervention, the entrepreneurs should keep in close contact with the leading animal advocacy organizations to avoid hindering the progress of the ongoing cage-free and Better Chicken Commitment campaigns. We have done as much desk research as we can, but we are less certain that we have chosen the best approach to improving the quality of egg-laying hen feed than we would be in other cause areas with higher levels of evidence, or than we would be if we could have visited a few farms in the most promising countries.

Description of the intervention

The intervention explored in this report is feed fortification. This is the enrichment of chicken feed with calcium, phosphorus, and vitamin D3 [1] [2] [3]. It aims to address a major source of suffering for egg-laying hens: pain resulting from bone fractures and osteoporosis.

We initially considered pairing this feed fortification ask with another food quality ask: advocating for alternative methods of feed restriction. Alternatives to traditional feed restriction would change the quality of feed rather than limiting the quantity. Traditional feed restriction methods can harm welfare, causing chronic hunger among the animals and increasing the incidence of feather pecking. Reduced-energy-content or reduced-protein-content feed aims to avoid the rapid growth rate without compromising welfare [5] [6]. However, this report focuses only on feed fortification as advocating for alternative methods of feed restriction does not look promising as a means to improve welfare. These alternative methods: 1) rely on plausibly controversial assumptions and lack support among animal advocacy groups; 2) could be net negative if we were to impede the shift toward slow-growing breeds; and 3) do not significantly affect the cost-effectiveness of a food quality intervention. Our research on feed restriction can be found in Supplement A.

Summary conclusion

Taking into consideration all of the information from the four methodologies, feed fortification shows promise. It scored particularly well on the weighted factor model, as the most evidence-based intervention considered this year. Multiple lines of evidence suggest that feed fortification has a positive effect on bone strength and bone breaking strength, which leads to a reduction of bone fractures and in the incidence of osteoporosis. These outcomes are important for chicken's welfare and have the potential to affect many welfare points.

This intervention also looks quite cost-effective. It is important to note that we model the cost-effectiveness of this intervention with a subsidization approach. We expect subsidization to be the least cost-effective approach for this intervention because the scale is limited, as the limiting factor becomes the number of farms you can work with in a given year; and the costs are high, with subsidization costs of around $27K per farm. Subsidization was modeled as it is the most suitable approach in India, the country where this intervention looks most promising. We consider other potential approaches and country pairings in the implementation report.

The table below offers a step-by-step summary of our research process for this intervention and the main takeaways from each stage. Color-coding reflects how well the intervention performed at each stage. The idea sort, idea prioritization, supporting reports, and related reports involve background research prior to this report that are not considered in the final decision on the promise of this intervention.

Report type	Summary results	Deeper reading
Idea sort	During the idea sort, this idea showed promise: it was in the top 22 of 395 total ideas, scoring well in all areas.	Full report Process
Idea prioritization	After two hours of researching food quality using the weighted factor model methodology, it was one of our highest priorities for more in-depth research as it was among the top eight ideas.	Full report Process
Prior view (section 1.)	This 80-hour report begins with a prior view, which summarizes the lead researcher's expectations before starting in-depth research. Prior knowledge of this area was mostly informed by our 2019 feed fortification report. At this stage, food quality looked	Process

	likely to become one of our recommended charity ideas.	
Informed consideration (section 2.)	Informed consideration occurs at two stages of our research process: the start and the end. Two sections in the report reflect this chronology. At this first stage, we explore what factors are likely to drastically affect the intervention (crucial considerations). We: i) researched the difference between optimum nutrient levels and current feed standards, and determined that there is a substantial gap that can be addressed; and ii) selected a few candidates for a country where the intervention may be executed based on the above factors, concluding that India might be the priority country. Overall from this perspective, the intervention looked promising.	Supplement B Process
Expert view (section 3.)	After examining crucial considerations, we discussed the intervention with experts including animal nutritionists, advocates, and farmers. During these conversations, experts raised concerns about humane washing for feed fortification. Broadly 66% of experts thought feed fortification looked promising and were interested in a charity being started in this field.	Process
Weighted factor model (section 4.)	The next stage of our research involves a weighted factor model. We scored the intervention based on preset criteria and weightings, and generated a causal chain. In this case, food quality scored well with an overall score of 33.0/50. The score can be broken down as follows, with the weighting of each criterion in parentheses: 7/10 for strength of the idea (2), 6/10 for limiting factors (1.5), 7/10 for execution difficulty (1), and 6/10 for externalities (0.5).	Process
Cost-effectiveness analysis (section 5.)	In our cost-effective analysis, we quantify welfare in terms of dollar cost. Our findings suggest that a food quality intervention would be a moderately cost-effective way to reduce suffering. Feed fortification affects roughly 7.5 welfare points and spares around 2.2 hens from broken bones per dollar when considering co-founder and funding counterfactuals, and 29.5 welfare points per dollar without these counterfactual considerations.	Supplement C Process
Informed consideration (section 6.)	The second part of our informed consideration closes the report. This internal contemplation allows researchers to reflect on the data and evidence gathered throughout the process. In this writeup, the lead researcher and director of research summarize key conclusions and offer overall thoughts on food quality as an intervention.	Process

Supporting reports	Three supporting reports are relevant for this intervention. Our weighted animal welfare indexes on egg-laying hens and broilers (Supplement D) suggest that these are likely priority animals. The "why focus on animals?" report details why we think animal advocacy is a high impact area on which to focus.	Supplement D Why focus on animals?
Related reports	The 2019 feed fortification report suggests this could be a cost-effective intervention.	2019 report

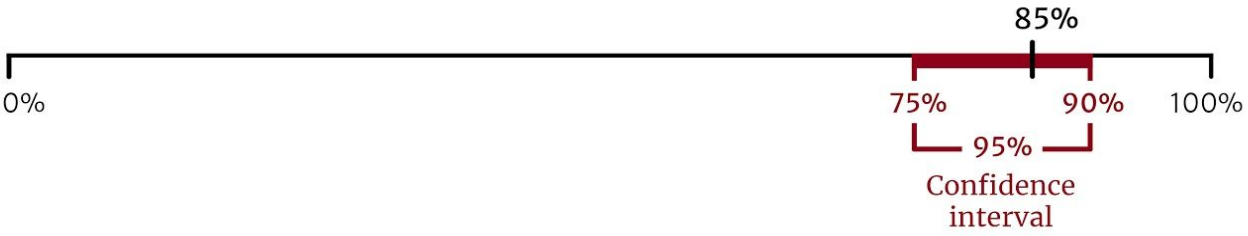
1 Prior view

This brief section summarizes our team's thoughts on this intervention before starting in-depth research.

We expect this intervention to be in the top third of those we consider. We would not be surprised if it becomes a recommended charity idea, as feed fortification was last year. It will likely be cost-effective and fairly easy to found.

We are concerned that farmers are tired of campaigns for farmed chickens. This means they may be unwilling to cooperate, damaging the probability of this charity's success.

At this stage of the research, our subjective likelihood of recommendation is:



This probability estimate assumes that:

- Two animal advocacy ideas (from the 2020 research round) will be recommended at the end of the research process, so being recommended is equivalent to being in the top two ideas.
- With no prior information, each idea is equally likely to be recommended. Because we plan to consider 7 ideas in total, this means the prior probability is 2/7 * 100 = 29%.
- Because this intervention came out very promising in the previous stage of the research, we have updated the likelihood of recommendation to 85%.
- The 95% confidence interval represents how sure we are that there is an 85% chance this idea will be in the top two ideas. At this stage we had not done very much research in this area (though more than the other interventions considered this year as we did a report on this last year too), though there are some strong indications that this is a good idea, such as last year's research on this intervention.

1.1 Informed consideration

The impact of this intervention depends on feed standards in the target country. Our team expects that standards will be poor in our priority countries [1]. This suggests that the intervention could be highly impactful.

1.2 Expert view

We think that this idea will be popular among experts who tend to favor interventions that tackle chronic suffering over those that focus on acute suffering (e.g., handling or slaughter).

1.3 Weighted factor model

We believe that this intervention will score slightly above average (6–7) in all areas of the weighted factor model.

The score for execution difficulty will likely be the lowest. This is because farmers seem to be losing patience with farmed chicken welfare campaigns, and will be less likely to cooperate.

The score for the strength of the idea will likely be the highest, although we would like more research to be entirely confident that feed fortification reduces bone fractures and fragility. This high score for strength of idea should accord with the potentially high cost-effectiveness of this intervention.

1.4 Cost-effectiveness

We think it is likely that this intervention will be cost-effective, as a 5-minute CEA for feed fortification placed it in the 70th percentile of all considered interventions. Additionally, last year's cost-effectiveness estimate of feed fortification was high, at $0.22 per welfare point [2].

2 Informed consideration: Crucial considerations

After the prior view, we began the research process by identifying crucial considerations for food quality. In this early phase, we identified:

- optimum calcium, phosphorus, and vitamin D3 levels for egg-laying hens
- current feed standards for egg-laying hens in the top five egg-producing countries

The following subsections summarize our findings on each of these four crucial considerations. Further information including sources and data is available in Supplement B.

2.1 What are the optimum nutrient levels?

Endline optimum nutrient levels were calculated in Google Sheets [13] using various sources. We conducted a rapid literature review on this topic and found eight papers; we averaged the results of these including confidence intervals. All sources can be found in Supplement B, section 2.1.

Calcium

White egg-laying hens	Brown egg-laying hens	Non-specific egg-laying hens
3.28%	3.62%	3.99%

Phosphorus

White egg-laying hens	Brown egg-laying hens	Non-specific egg-laying hens
0.3%	0.3%	0.3%

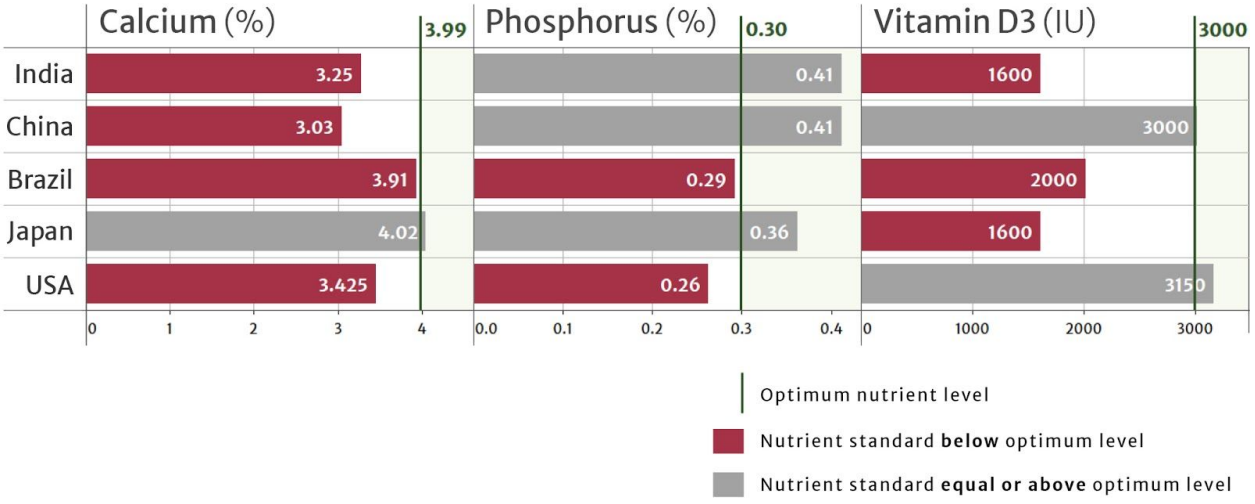
Vitamin D3

White egg-laying hens	Brown egg-laying hens	Non-specific egg-laying hens
3000 IU	3150 IU	3000 IU

2.2 What are current feed standards like?

We looked at the calcium, phosphorus, and vitamin D3 standards of the top five egg-producing countries. A rapid literature review on this topic yielded six papers; we averaged the results of these including confidence intervals. All sources can be found in Supplement B, section 2.2.

The following graph shows the difference between their nutrient standards and the optimum nutrient levels:



Priority countries

Based on our findings and on previous priority country research, we ranked countries in order of priority for improving feed standards:

1. India
2. China
3. Brazil
4. Japan
5. USA

3 Expert view

This section summarizes conversations between the lead researcher and a range of experts, including advocates, farmers, and animal nutritionists.

Overall, experts held mixed views about the promise of feed fortification.

The main concern for critics was humane washing. The biggest update was that the Bureau of Indian Standards' (BIS) poultry feed standards seem to be merely recommendations. As a result, feed standards on most farms are likely worse than the standards suggest. This means we likely stand to affect more welfare points than we initially expected.

Anonymous animal advocate working in India

Profile: This individual wished for their comments to remain anonymous. We contacted them to learn what animal advocates working in India think of feed fortification as an intervention to help animals.

Summary: This individual was concerned that feed fortification would undermine the work of animal advocates attempting to forestall industrial animal agriculture in the country through meat alternatives. They also believed that, as India is in the installation phase of industrial animal agriculture, any humane washing now would have an outsized effect as the industry grows.

More information can be found in the conversation summary.

Dr. Vishnu Vrardhan Reddy Pulimi

Profile: Dr. Vishnu Vrardhan Reddy Pulimi works with the government of Andhra Pradesh as an animal nutritionist, dairy consultant, and veterinary assistant surgeon. We contacted him to gain information about poultry feed standards and their implementation.

Summary: The poultry feed standards of the BIS are only recommendations. As a result, only 10% of farmers who make their own feed (around 50–60% of farmers according to Dr. Vishnu), and only 60% of feed producing companies follow these standards.

More information can be found in the conversation summary.

Shreya Paropkari

Profile: Shreya Paropkari is another animal advocate working in India. She is also a member of several BIS committees. We contacted her to learn more about BIS and the process of developing poultry feed standards. We also wanted to hear from another animal advocate in India after hearing the anonymous advocate's concerns.

Summary: The Animal Husbandry Feeds & Equipment Selection Committee within the Food & Agriculture Department of BIS deliberates on feed standards. The Food and Agricultural Department meetings, when called, generally break the invitees into committees that will be allocated standards on which to deliberate. The meetings include industry stakeholders, research institute representatives, scientists, and veterinarians.

Shreya expressed no concerns about humane washing. She thought that this intervention seems to be a parallel approach to other interventions attempting to alleviate the suffering of egg-laying hens and that for the hens in battery cages, the small change in their bone strength - as insignificant as it may seem to us in the larger picture - definitely goes a long way.

More information can be found in the conversation summary.

Ashok Kannan

Profile: Ashok Kannan is a free-range egg farmer and co-founder of the Happy Hens Farm in India. We contacted him to learn about feed standards on a farm that does not follow BIS poultry feed standards.

Summary: The feed standards on the Happy Hens Farm are better than those recommended in the BIS poultry feed standards. Ashok was unaware of any other farms with comparable feed standards. It was unclear whether this was because Ashok does not know what feed standards are like on other farms or because feed standards on other farms are worse. However, as a free-range egg farm, Happy Hens Farm is likely to have better welfare (and thus better feed standards) than the average farm.

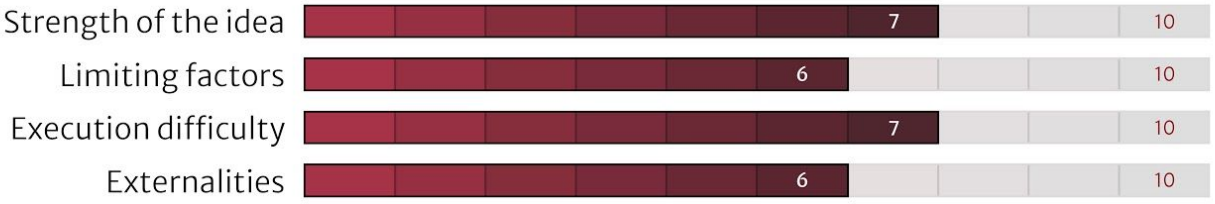
More information can be found in the conversation summary.

4 Weighted factor model

In this stage of research, we scored the food quality intervention based on preset criteria and weightings. We also generated a causal chain.

Overall, the weighted factor model suggests that feed fortification is a strong intervention.

This graphic shows the score of the intervention in each area:



4.1 Strength of the idea

Score: 7/10

The evidence base for feed fortification is stronger than that for any other intervention we have considered this year. We found ten studies evaluating the effect of calcium, fourteen on the effect of phosphorus, and six on the effect of vitamin D3 on hen welfare. These studies suggest that fortification will decrease mortality and increase bone strength and tibial breaking strength. These increases in bone strength and tibial breaking strength will reduce the incidence of fractures and will allow the hens to move around so that they can freely access their food and drink. Though these reported effects look preliminarily promising we would like to see more research in this area to increase our confidence.

We expect feed fortification to be moderately cost-effective. The majority of farmers and some feed producers seem not to follow feed standards [16], so the number of welfare points we stand to affect may be large in practice.

4.2 Limiting factors

Score: 6/10

We expect funding to be the main bottleneck for feed fortification. As the subsidization costs per farm are around $27k, this intervention can get expensive quite quickly.

With the seed grant from the Incubation Program, we think it essential that the co-founders run micro-pilots on willing farms to test the optimum levels of calcium, phosphorus, and vitamin D3 that have been found from this research. These micro-pilots will quickly provide proof of concept for the positive effects of feed fortification, which will be essential for future fundraising success given the large expected funding needed per year. We think that successful micro-pilots will be necessary for the fundraising of this charity, as feed fortification provides less of an easy story to sell than something like removing laying hens from cages.

We have currently modeled the probability of fundraising success at around 30%. We expect that this probability could be increased if the cost of subsidization per farm could be decreased. For example, partnering with a calcium manufacturer could provide a discount given the large upfront bulk order of calcium needed for micro-pilots and any future farms worked with. We would also expect the probability of fundraising success to be different when considering a different approach. This point is further explored in the implementation report.

4.3 Execution difficulty

Score: 7/10

We expect the main barrier to this intervention working well to be that supplementing chicken feed could be more difficult than it seems from desk research. It is possible that giving farmers a premix of the correct amount of calcium, phosphorus, and vitamin D3 is not enough to ensure that feed has optimum standards. For example, it might be necessary to give them an additional part for their feed mill to enable them to add this premix. However, from brief research it seems that there is no extra equipment involved in adding the premix. Nonetheless, we will explore this further in the implementation report.

Feedback loops should be quick, and success metrics should be easy to measure (e.g. broken bone rate) and informative even if taken only once per chicken's life.

4.4 Externalities

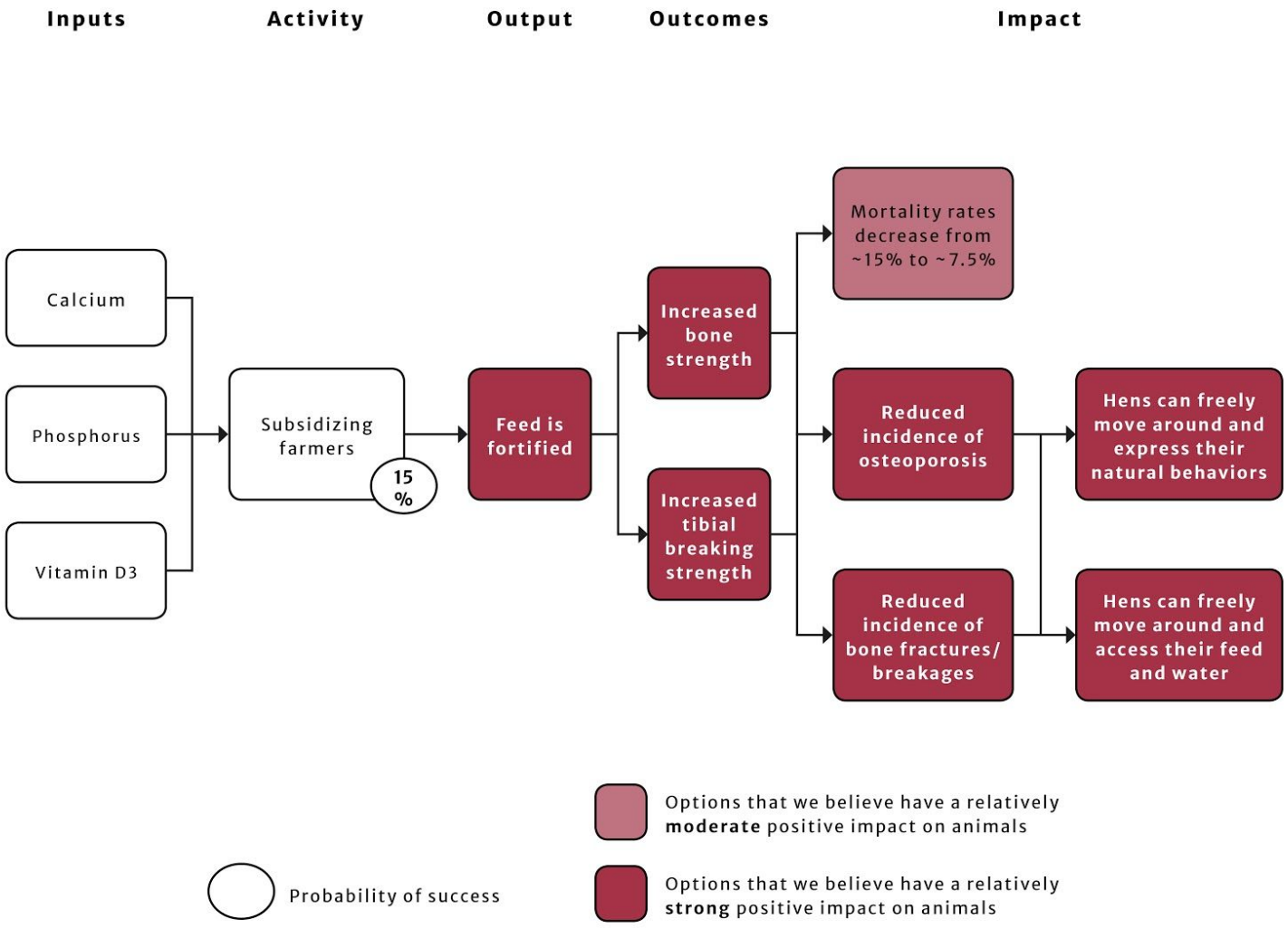
Score: 6/10

Skills and lessons gained through this intervention would be transferable to outreach and cooperation in other industry-type interventions. Although the

nonprofit field for improving the quality of farmed animals' feed is currently non-existent, it would be relatively easy to establish. As this intervention will likely be implemented in India, it could also positively contribute to building the animal advocacy movement in important neglected countries.

As well as these benefits, the intervention has its downsides. The main downside of feed fortification could be humane washing. Concerns about humane washing were raised by one expert, but these were contradicted by other experts who thought that humane washing was unlikely. We struggled to find any empirical research on humane washing that would give us a good sense of whether this is a valid concern.

4.5 Causal chain



5 Cost-effectiveness analysis (CEA)

This section summarizes our CEA, which weighs the likely cost of this intervention against the likely good accomplished. To quantify impact for animal welfare interventions, we use a system of welfare points (adjusted for probability of sentience and expected lifespan). Our cost-effectiveness analyses quantify the number of such welfare points we expect to affect per dollar spent.

Our CEA models the impact of subsidizing supplements for farmers to encourage them to provide feed with appropriate nutrient levels. This approach is not necessarily recommended as a path forward for entrepreneurs, but was chosen to provide a rough sense of the cost-effectiveness of working on feed fortification. Entrepreneurs may pivot based on their own research: for example, they may instead partner with certifiers to encourage them to include feed standards for calcium, phosphorus, and vitamin D3 in their standards.

Detailed discussion of the CEA is laid out in Supplement C.

5.1 Overview

Our model suggests that feed fortification for factory-farmed chickens may affect a total of 7.5 welfare points (WP) per dollar (considering co-founder and funding counterfactuals), and help roughly 2.2 million hens. In this case, "hens helped" refers to the number of hens who no longer have fractured or broken bones due to calcium, phosphorus, and vitamin D3 deficiency. This allows the hens to move around so that they can freely access their food and drink.

	WP per $
With counterfactuals	7.5
Without counterfactuals	29.5

We took into account the following factors in our CEA:

- Probability of success
- Affecting factors
- Direct effects
- Indirect effects
- Costs
- Counterfactuals
- Years operating

- Where our CEA could go wrong

Our considerations for these issues are laid out in the sections below. Further discussion can be found in Supplement C.

5.2 Probability of success

These percentages are an average of the probabilities of success given by our team:

Execution success: 50%
Probability of fundraising success: 30%

Combining the two, this gives us an overall probability of success of 15%.

5.3 Affecting factors

Affecting factors are the variables that could change cost-effectiveness the most. The table below shows the impact of affecting factors.

The r^2 value used here for each factor reflects how much of the variance in cost-effectiveness is explained by variance in that factor. That is, using an example from the table below, if the WP affected per hen per year is changed, this will change the cost-effectiveness of the intervention by a significant amount. Factors are color-coded to reflect the extent to which they alter cost-effectiveness, from red (does not change cost-effectiveness) to green (significantly changes cost-effectiveness).

WP affected per hen per year assuming feed standards not followed (r^2)	Number of hens affected per year (r^2)	Number of farms we can work with each additional year (r^2)
0.69	0.28	0.27

5.4 Direct effects

To calculate the direct effects of feed fortification, we took into account:

- Lifespan of an egg-laying hen
- Welfare points affected
- Number of hens affected
- Percentage of farmers and feed producers who follow BIS feed standards

- Number of farmers we can work with in the first year, and in following years

Putting these all together, we estimate that we could affect 43 million lifetime welfare points.

5.5 Indirect effects

There are no indirect effects for this scenario as we are subsidizing the cost of supplementation ourselves, rather than getting the farmers to pay for it. Therefore, we would not expect any change in the price of eggs and therefore no reduction in demand.

5.6 Costs

The relevant costs for this intervention were as follows:

- Staff costs: $100K
    - Based on: number of founders; founders' salaries; number of other staff; other staff's salaries.
- Logistics & administration costs: $13K
    - Based on: travel (international & domestic); office space; subscription costs.
- Subsidization costs: $6.6M
    - Based on: cost per kg of calcium, phosphorus, and vitamin D3, and the required amount of calcium, phosphorus, and vitamin D3 per chicken per year to calculate the cost of supplementation per hen per year.

Using these numbers, we estimate the following costs:

- First year costs: $166K
    - Based on: co-founder salaries; international and in-country travel; office costs; subscription costs; and micro-pilot costs.
- Charity costs per year: $210K
    - Based on: staff costs, logistics and administration costs, and the cost of subsidization.

The cost of subsidization is the dominating cost for this intervention, at approximately $27K per farm. The total subsidization costs are calculated by multiplying the cost of supplementation per hen per year (around $0.34) by the total number of hens affected (roughly 290K additional hens per year given five new farms are worked with each year) and the lifespan of an egg-laying hen as a

percentage of a year (hens are typically kept until they are 72 weeks old, which is roughly 138% of a year).

5.7 Counterfactual costs

The relevant counterfactual costs for this intervention are as follows:

- Co-founder counterfactuals: 32M WP
    - Based on the value co-founders could contribute at other high-impact organizations or through earning to give.
- Funding counterfactuals: 340K WP
    - Based on: amount of funding diverted per year from high- and medium-impact charities; estimated impact of high- and medium-impact charities.

5.8 Years operating

We have estimated that this charity will operate for around ten years. The first year will involve running micro-pilots to provide the proof of concept for the intervention and to test the optimal nutrient levels found through desk research. The remaining nine years will be spent working directly on the intervention using the chosen approach. We have modeled a subsidization approach but think that the entrepreneurs should be open to other pathways, such as partnering with certifiers, a corporate campaign*, or a governmental campaign.

** Note: We do not want to hinder the progress of the ongoing cage-free and Better Chicken Commitment campaigns. Because of this, it seems like a corporate campaign is not the most promising approach in the short-term, and that it would be best to wait until these existing campaigns have wrapped up before launching a new campaign (most deadlines are in 2025).*

5.9 Where our CEA could go wrong

We considered how our CEA could go wrong in each step. Some general potential issues include:

- Best guesses and value judgments: certain figures are estimates by Charity Entrepreneurship staff. Another person could look at the same evidence and come to a different conclusion. Those with different judgments should copy our models and insert their own estimates. These best guesses and value judgments include:
    - Probability of success of each scenario
    - Number of welfare points affected by feed fortification

    - Number of farms that the charity can work with each year (under the subsidization approach)
- Incomplete knowledge: it is unclear what feed standards are like in farms that do not follow BIS recommendations, for example.
- Other factors: with an 80-hour summary report, it is impossible to exhaust every angle. There are likely factors that may affect the CEA in ways we cannot predict. Equally, factors inherent to our modeling may influence the results of the CEA.

For further discussion of our CEA, please see Supplement C.

6 Informed consideration: Internal contemplation

In this stage, we analyzed all the data and insights gathered through previous steps in the research process. The most important conclusions from each are summarized here, as are our team's overall thoughts on food quality as an intervention.

6.1 Crucial considerations

Summary: At this stage the intervention looked promising, with substantial gaps to be addressed in India.

When looking at the existing feed standards in the top egg-producing countries we found substantial gaps. The gap was biggest for India, where the standard for calcium is 0.74% below the required level of 3.99% and the standard for vitamin D3 is 1400 IU below the required level of 3000 IU. Phosphorus is slightly above the required level of 0.3%.

6.2 Expert opinions

Summary: 25% of experts had concerns about humane washing and thus were unsure whether a charity should be founded based on this intervention idea. On the other hand, 75% of experts thought that this intervention could be promising, with one expert directly contradicting the concerns about humane washing. Conversations with experts weakly positively updated us towards the promise of the intervention, as feed standards are likely worse in India than the feed standards would suggest.

We struggled to find any empirical research on humane washing to have a good sense of whether this is a valid concern.

We were surprised to learn that the poultry feed standards from the Bureau of Indian Standards (BIS) were recommendations rather than standards to be enforced. Only 10% of farmers and 60% of feed producers follow BIS standards.

It is difficult to find information about nutrient levels of feed among farmers or producers who do not follow the standards. We spoke with one farmer, Ashok Kannan, who did not follow BIS standards, and used a higher feed standard than required. We are not convinced that Ashok is representative of all farmers that do not follow feed standards, however, as he is a free-range egg farmer, while most

egg-laying hens in India are kept in cages. It is also possible that since Ashok has free-range hens, he is more likely to be concerned with welfare than the average egg farmer in India, and therefore we may expect his feed standards to be optimum.

6.3 Weighted factor model

Summary: At this stage the intervention looked promising, mostly due to its strong evidence base.

This intervention scored particularly well on the strength of the idea given that the evidence base is much stronger than for any other intervention we have considered this year.

Two main concerns were raised at this stage. Firstly, co-founders will need to act quickly to provide the proof of concept needed to fundraise the large amounts needed for subsidization. Secondly, it is possible that our perception of the ease of improving feed standards on farms through providing a premix of the correct amounts of calcium, phosphorus, and vitamin D3 is misleading, and that it will in fact be more difficult than this.

6.4 Cost-effectiveness analysis

Summary: We expect this intervention to affect 7.5 welfare points per dollar given a subsidization approach, with an overall probability of success of 15%. We expect the charity to work with an additional five new farms per year after the micro-pilots are successfully completed.

This intervention still looks promising when modeled using the subsidization approach, which we expect to be the least cost-effective approach in the animal advocacy space. We are excited to explore different approaches in the implementation report with the potential to be even more cost-effective.

6.5 Overall thoughts

This intervention looks strong enough to recommend in 2020. We are excited about starting a charity focused on feed fortification given the historical level of success of micronutrient charities in the poverty space, and the success of a previous Charity Entrepreneurship-incubated micronutrient charity (see Fortify Health). We think that a new charity has the potential to be a leader in a novel field of improving the quality of farmed animals' feed, a tractable and neglected area in animal welfare.

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