Amazon Purchase of Whole Foods Market Risk Assessment

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1.0 Introduction and Background

Amazon's acquisition of Whole Foods greatly expands its grocery business. With over 400 Whole Foods store locations Amazon is now in the position of making a bigger impact in-store, online and with meal-kit delivery. While Amazon has the tech and customer data collection capabilities to create an experience for its customers, Amazon is entering a market with grocery giants such as Wal-Mart and Kroger, and well-established home delivery meal-kit companies like Blue Apron and Hello Fresh. To compete with other grocers, Amazon will be lowering prices on certain Whole Foods products, as well as offering online ordering with in-store pick up. To gain market share in the online realm, Amazon has already launched a selection of meal-kits that can be purchased online and shipped to customers. This hypothetical project will look into the risks faced by Amazon as part of its acquisition of Whole Foods.

2.0 Initial Risk Planning and Methodology

During the course of seven weeks the team met to identify risk events in collaborative sessions using innovative risk software Riskion. The team initially started to identify the risk associated with this project, and brainstormed the additional risk Amazon was taking in transitioning customers who were accustomed to shopping in stores and converting them to online grocery shoppers. This expanded into planning for risk associated with an influx of customers, the demands that would place on inventory, the need for increased staffing, the attention that must continue to be place on quality, and the increased demand on technology.

As a team we identified the sources of each of the risk events we listed, and the likelihood of those sources and events happening. The ultimate goal driving the development of the risk register was to ensure current amazon shoppers would be motivated to purchase Whole Foods groceries along with their books and electronics, and for new customers to come in for groceries and stay Amazon customers because of the excellent on-line experience that could replace in-store shopping. Anything that got in the way of that process being seamless was considered in this analysis. We then laid out the objectives of both Amazon and Whole Foods, the impacts on the objectives considering the risks we identified, identified and selected controls to reduce the risk, and analyzed the risks pre-control and post-control.

Following initial brainstorming, the team methodically built the framework into a structure that would be used throughout the analysis in assigning roles to participants, setting methods for how to measure the categories of the structure, and how to assign controls to the identified risks that would ultimately reduce impact on the organizations objectives. The result of the analysis is a recommended scenario of cost allocation to a selection of controls that can be applied to reduce the risk of events that could potentially occur due to the acquisition. The team utilized Riskion to build the analysis and generate the results which are presented in this report.

2.1 Participants and Roles

Our team took on the roles of Amazon and Whole Foods Market Chief Risk Officers to place judgements on the top risk the company would face and how those risk could be amplified as more customers began shopping for Amazon and Whole Foods product. As part of the initial

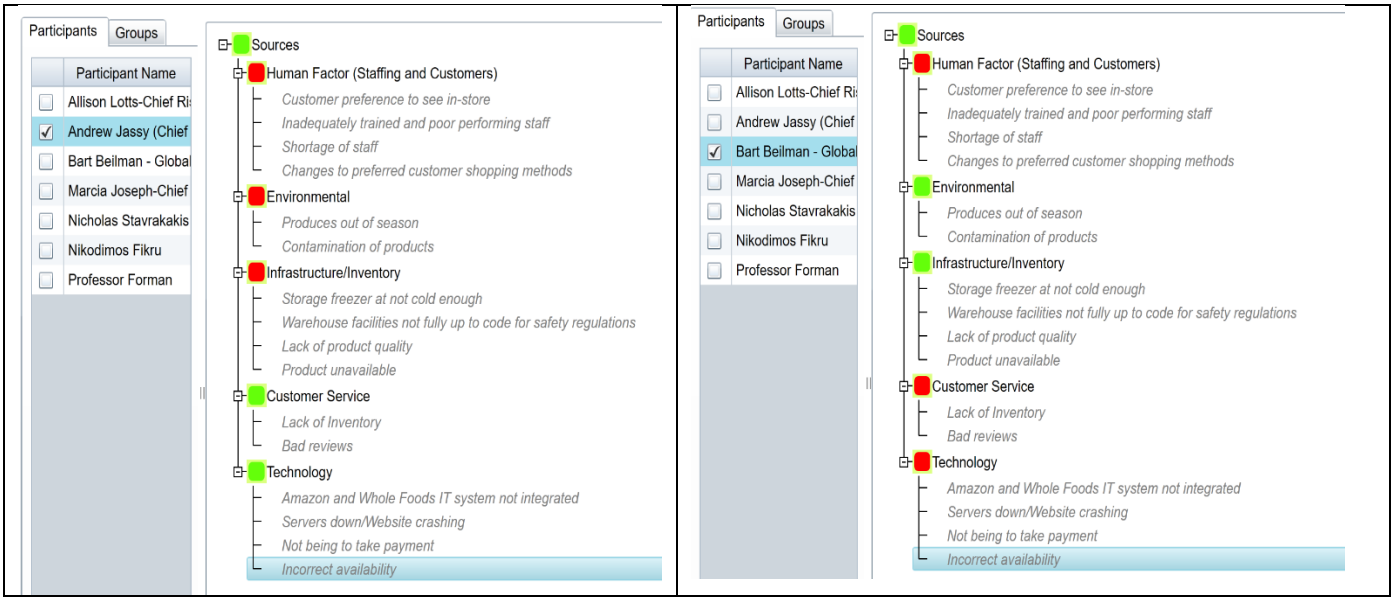
risk planning, the team identified initial concern in the areas of customer service and meeting customer supply and demand. Therefore, we decided that by adding Amazon Web Services Chief Executive Officer to the team it would provide us with input on the risks and challenges that Amazon currently faces being an online business. We also brought on Whole Foods Global Vice President of Supply Chain and Retail Operations to help identify some of the risks that could be encountered in trying to meet the demands of the current Whole Foods customer and how that could affect the online market. A list of principle participants is shown in Figure 1.

Figure 1: Participants

Participant Name
Allison Lotts-Chief Risk Officer for Amazon
Andrew Jassy (Chief Executive Officer-Amazon Web Services)
Bart Beilman - Global V.P., Supply Chain & Retail Operations
Marcia Joseph-Chief Risk Officer for Whole Foods Market

These participants were assigned roles in Riskion based on their area of expertise. These roles would later determine which judgements would be required to be made by each participant (discussed in Section 5.0). Figure 2 shows the "Sources" roles assigned to Andrew Jassy and Bart Beilman. Roles were also assigned for judgement of events and objectives. The development of sources, events, and objectives are discussed later in this report.

Figure 2: Participant Roles



3.0 Identifying Events and Sources

The first step in identifying risk events is to understand what a risk event is, and what it is not. A risk event is the uncertain occurrence of a loss to one or more of the objectives. The team met as the Amazon and Whole Foods Market Chief Risk Officers to brainstorm the top risk events that both Amazon and Whole Foods faced as a company. At this point in the development of the project, the team did not have a finite list of objectives (these were brainstormed later and is discussed in Section 4.0), but we were able to brainstorm events that if they occurred would surely cause a loss to something. We pulled from personal shopping experiences and brainstormed into the technological capabilities that must be required for Amazon and Whole Foods systems to be functional, as well as thought about the supply management pillar of strength that must exist to support the high demand and large customer base that Amazon has. Events that related to Amazon's meal kit service were then added as well as the potential for customers to bring their business to competitors such as Blue Apron face. The initial list of events is shown in Figure 3.1, but was reduced to the final list shown in Figure 3.2. Previously identified risk events were removed to keep the scope of the analysis manageable, but these are areas that Amazon could continue to investigate.

Figure 3.1: Risk Events - Initial

Unique ID	Events
[03]	Grocers undercut Whole Foods' already reduced prices
[04]	Customers stop shopping in-store due to online convenience
[05]	Customers do not select Amazon/Whole Foods when online shopping
[06]	Failed implementation of Amazon/Whole Foods online ordering
[07]	Inability to staff Whole Foods to support online orders
[08]	Online orders missing products
[09]	Online orders requiring substitute products
[10]	Online orders not prepared in time for customer pick-up
[11]	Inability to onboard customers into Amazon/Whole Foods loyalty program
[12]	Customers do no purchase produce online
[13]	Customers do not purchase meats online
[14]	Customers do not select Amazon/Whole Foods meal-kits when shopping online
[15]	Meal-kits delivered late
[16]	Meal-kits missing products
[17]	Meal-kits contain rotten/damaged products
[18]	Failed meal-kit packaging

Figure 3.2: Risk Events - Final

Unique ID	Events
[04]	Customers stop shopping in-store due to online convenience
[06]	Failed integration of Amazon/Whole Foods online ordering
[07]	Inability to staff Whole Foods to support online orders
[08]	Online orders missing products
[09]	Online orders requiring substitute products
[10]	Online orders not prepared in time for customer pick-up
[12]	Customers do no purchase produce online
[13]	Customers do not purchase meats online
[15]	Meal-kits delivered late or missing products
[17]	Meal-kits contain rotten/damaged products
[18]	Customers do not complete order online

3.1 Events Description

Below is a description of the eleven risk events identified by the team during the risk analysis process that would pose a loss to Amazon's objectives (objectives discussed in Section 4.0).

1. Customers stop shopping in-store due to online convenience: With the added convenience of being able to place orders online, stores may see a decrease in foot traffic which could impact in-store sales and pressure on inventory levels to support increased online sales.

2. Failed implementation of Amazon/Whole Foods online ordering: To compete with other grocers that allow customers the convenience of doing their grocery shopping online and picking up in-store, Amazon/Whole Foods online ordering tool must be successfully rolled out to all stores. If unsuccessful, customers may not use Amazon to purchase their groceries online.

3. Inability to staff Whole Foods to support online orders: With the acquisition of Whole Foods, a level of additional staff will be necessary to fill online orders. Seasoned Whole Foods employees must train new employees to fill orders as the online branch gets off the ground. Failure to employ and train the appropriate level of staff would be detrimental to the success of filling online orders.

4. Online orders missing products: When filling orders for Whole Foods purchases, orders may be missing items that are sold out or out of season. Additionally, orders could be missing items due to lack of employee attention to detail. This could cause customers to not repeat an order in the future.

5. Online orders requiring substitute products: An item is out of stock and needs to be replaced with an alternate item in order to complete the order (ex: a customer orders a gallon of regular 2% milk at $2.99 and a gallon of organic 2% at $5.99 is sent instead to complete the order). While this method may be satisfactory to customers, it may cause

frustration that the requested items were not available. Repeat substitutions may lead to customers looking to other stores to fill their orders.

6. Online orders not prepared in time for customer pick-up: During the holidays/rush hour, the stores are extremely busy. There is an increase in online shoppers who are trying to beat the long lines and place order online to be picked up. Customers expect orders to be ready at the time they are told. An occasional delay may not cause any customer frustration, but multiple occurrences of delays may cause a customer to leave.

7. Customer do not purchase produce online: There are customers who like to smell, touch and feel their produce and prefer to purchase items such as these in person. This could reduce produce purchases online.

8. Customer do not purchase meat online: There are customer who prefer to select the cut of meat and select meats that are fatty, lean, with or without bone. This could reduce meat purchases online.

9. Meal-kits delivered late or missing products: Select items for a recipe maybe out of season or have been left out by the employee packing the order, causing a kit to be missing an item that cannot be filled. Amazon should ensure out of season items have acceptable substitutes and customize available recipes to those products that are in season. Employees must ensure all items are packaged into the order prior to shipment. Late kits or kits with missing items risk loss to returning customer business.

10. Meal-kits contain rotten/damaged products: Employees rushing to fill orders may not be paying attention to the shelf life or condition of the item they are packing. By the time the order arrives to the customer, the item may have turned rotten or may be damaged. This would cause a customer to essentially have a missing product to their recipe and could create customer frustration due to the inconvenience of having to purchase the item separately.

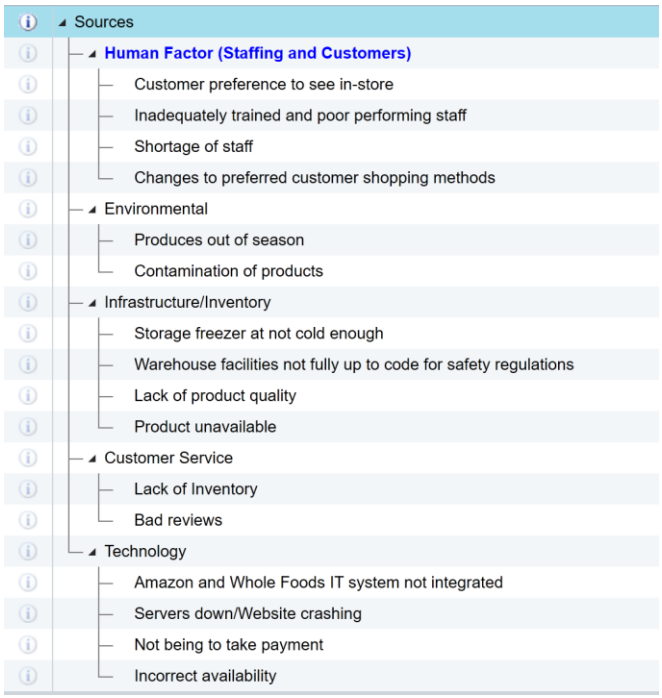
11. Customers do not complete order online: Customers fill their online carts with merchandise but never complete their order. This impacts sales and does not provide any information to Amazon on why the customer did not complete the order, making it challenging to know where improvement is needed.

3.2 Source Description/Hierarchy of Sources (Mapping Sources to Events)

Sources are different from risk events because the occurrence of a source does not directly cause a loss to an objective. However, a source can lead to the occurrence of a risk event, which does result in a loss. Sources were brainstormed using the Visual Brainstorming tool and then grouped together in homogenous clusters of 7 +/- 2 sources in each cluster (or category). This built a hierarchy of sources into the structure and is important in considering how much information the human mind can handle. We needed to ensure the clusters of sources included like items so when participants evaluated the relative comparisons they were able to better compare the items. It is much easier for the human mind to compare two technology related

issues for relative likelihood of one over the other, than it is to compare a technology issues to an inventory issue. The categories identified were Human Factor, Environmental, Infrastructure/Inventory, Customer Service, and Technology. Additional categories that were considered but removed when the model was refined were: Competition and Public Relations. Previously identified sources under these categories were removed to keep the scope of the analysis manageable, but these are areas that Amazon could continue to investigate.

Figure 3.3: Sources



Below is a description of the source clusters identified by the team during that could potentially lead to a risk event occurrence, and subsequently pose a loss to Amazon's objectives.

1. Human Factor: The human factor encompasses both human resource factors and customer preferences.
    - Inadequately trained and poor performing staff: filling of online orders (in store pick up) and meal-kits to deliver is a new line of business for Whole Foods employees. Until they can be properly trained and become more experienced there will likely be sub-par performance.
    - Shortage of staff: to support the increase in customers expected by the acquisition, Whole Foods stores will need to increase their staffing to support the increase in online orders (pick up in store). Until the desired amount of staff are hired, a shortage of staff will impact their operation.
    - Customer preference to see in-store
    - Changes to preferred customer shopping methods
2. Environmental
    - Produce out of season: produce being out of season will impact a customer's purchase. A customer is less likely to purchase something if they are forced to pick a substitute for a product that is not in season and therefore not available.

- Contamination of product: contamination of a product is the damaging of a product (e.g. rotting, animal infestation, freezer burn) that causes the product to be unavailable to a customer

3. Infrastructure/Inventory
    - Storage freezer not cold enough: equipment failure or employees not properly securing equipment can lead to temperatures being out of acceptable ranges for food storage causing a potential loss of product
    - Warehouse facilities not up to code: facilities must be up to code to be allowed to operate. Aside from being safe to operate in and protecting the product, external inspectors could shut down an operation if it fails to meet regulations. This could reduce the capability of filling customer orders.
    - Lack of product quality: Products stored improperly could become damaged or arrive to a customer in a less than acceptable condition. This could damage the reputation of having excellent product quality and make customers not return.
    - Product unavailable: Improper storage conditions could wipe out the selection of a product completely, making that product unavailable to a customer.
4. Customer Service
    - Lack of inventory: Not having the selection of inventory a customer demands could damage the reputation of Amazon and Whole Foods and lead to loss of customers.
    - Bad Reviews: Customers that have a negative experience for any reason could quickly go to the web and post a negative review. This could influence future customers to shop somewhere else or to not purchase certain products.
5. Technology
    - Amazon and Whole Foods IT system not integrated: The two IT infrastructures must be fully integrated to support filling customer orders accurately and on time.
    - Servers down/website crashing: Issues with the functionality of the website could stop a customer shopping experience in its tracks and cause loss of completed orders.
    - Not being able to take payment: Customers that cannot proceed through all the steps of their order will likely not complete their order.
    - Incorrect availability: Customers may add something to their order that is incorrectly showing as available when it is actually out of stock. This could result in loss of sales.

Part of brainstorming the sources in the Visual Brainstorming tool included selecting which sources applied to which events, and often times a source was applicable to more than one event. This mapping of sources to events created a Vulnerabilities Grid. Upon completion of visual brainstorming, we could see missing areas where no source was linked to an event and were able to iterate and discuss additional potentials for sources to ensure that all events were mapped to a source and vice versa. Figure 3.4 shows the final Vulnerabilities Grid.

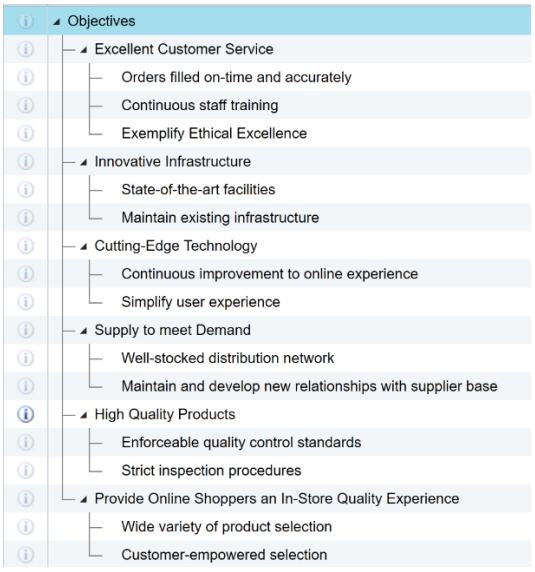
Figure 3.4: Vulnerabilities Grid - Sources Mapped to Events

Events	Sources: Human Factor (Staff: Customer pre	Inadequately	Shortage of s	Changes to p	Environ: Produces out	Contaminatio	Infrastructure/Invent: Storage freez	Warehouse fa	Lack of produ	Product unav	Custom: Lack of Inven	Bad reviews	Technology: Amazon and	Servers down	Not being to t	Incorrect avai
Customers stop shopping in-store due to online convenience				■												
Failed integration of Amazon/Whole Foods online ordering													■	■	■	■
Inability to staff Whole Foods to support online orders			■													
Online orders missing products		■	■		■	■	■	■			■					
Online orders requiring substitute products					■	■					■					
Online orders not prepared in time for customer pick-up		■	■													
Customers do no purchase produce online	■			■	■				■							
Customers do not purchase meats online	■			■					■							
Meal-kits delivered late or missing products		■	■			■	■	■			■					
Meal-kits contain rotten/damaged products		■	■			■	■	■	■							
Customers do not complete order online	■			■	■		■	■		■	■	■	■	■	■	■

4.0 Identifying Objectives/Hierarchy of Objectives (Mapping Events to Objectives)

Objectives were identified in a similar manner to the sources. The Visual Brainstorming tool was used to generate objectives from the previously identified risk events. In each risk event, the team brainstormed what loss would occur and then developed that into a consequence to an objective. For example, an online order missing a product would cause a loss to the objective of filling orders on-time and accurately. Some events began to point to similar objective categories, which allowed the formation of clusters with sub-objectives. The objective categories that we developed are: Excellent Customer Service, Innovative Infrastructure, Cutting-Edge Technology, High Quality Products, and Providing Online Shoppers an In-Store Experience. Figure 4 shows the Hierarchy of Objectives that was developed.

Figure 4: Objectives



As with the development of sources, developing the objectives in the Visual Brainstorming tool creates a mapping from each event to an objective. Following the first iteration of brainstorming the team viewed the Impacts Grid, looked for missing links between events and objectives, and iterated to develop additional sub-objectives or create a link that was missing between an event and the consequence to an objective. The final Impacts Grid is shown in Figure 4.1.

Figure 4.1: Impacts Grid - Events Mapped to Objectives

Events	Orders filled	Continuous si	Exemplify Eth	State-of-the-a	Maintain exist	Continuous in	Simplify user	Well-stocked	Maintain and	Enforceable	Strict inspecti	Wide variety	Customer-em
	Excellent Customer			Innovative I		Cutting-Edg		Supply to m		High Qualit		Provide On	
	Objectives												
Customers stop shopping in-store due to online convenience						■	■						■
Failed integration of Amazon/Whole Foods online ordering	■					■							
Inability to staff Whole Foods to support online orders	■	■				■							
Online orders missing products	■	■						■				■	
Online orders requiring substitute products	■	■						■				■	
Online orders not prepared in time for customer pick-up	■	■					■						
Customers do no purchase produce online	■	■		■						■		■	■
Customers do not purchase meats online	■	■		■						■		■	■
Meal-kits delivered late or missing products	■	■						■				■	
Meal-kits contain rotten/damaged products		■		■						■			
Customers do not complete order online						■	■					■	■

5.0 Measurement

5.1. Measurement Methods

Prior to participants making judgements, measurement methods and options were selected by the team. Measurement methods determine the type of question a participant would answer and therefore the experience level of the participant was considered. Pairwise comparison methods allow the participant to make a judgement on which source or event is more likely than another, using either a graphical or verbal scale. An example of a pairwise comparison verbal scale question is show in Figure 5.

Figure 5: Pairwise Comparison for a Source

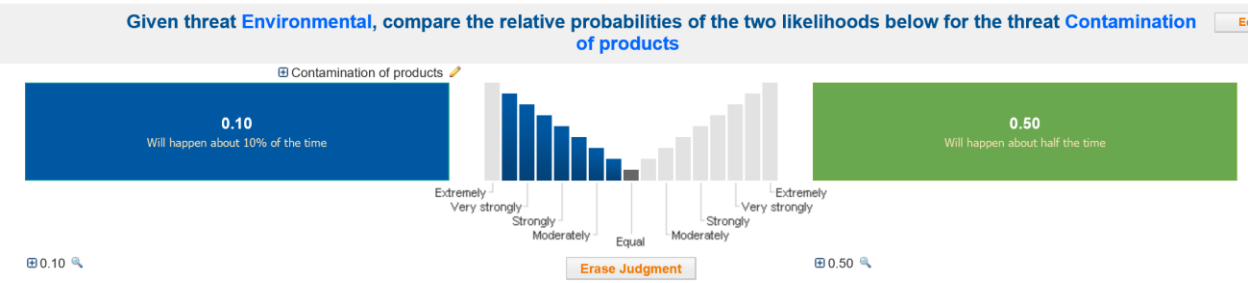
Pairwise comparisons question the participant to make judgements comparing different sources, events, or objectives. When comparing different sources, as seen in Figure 5, the participant is forced to make a decision on which is more likely. When comparing different objectives, as seen

in Figure 5.1, the participant is forced to decide which objective is more important to the organization. Being forced to place these judgements refines the accuracy of the judgement and derives priorities of the sources, events, and objectives.

Figure 5.1: Pairwise Comparison for an Objective

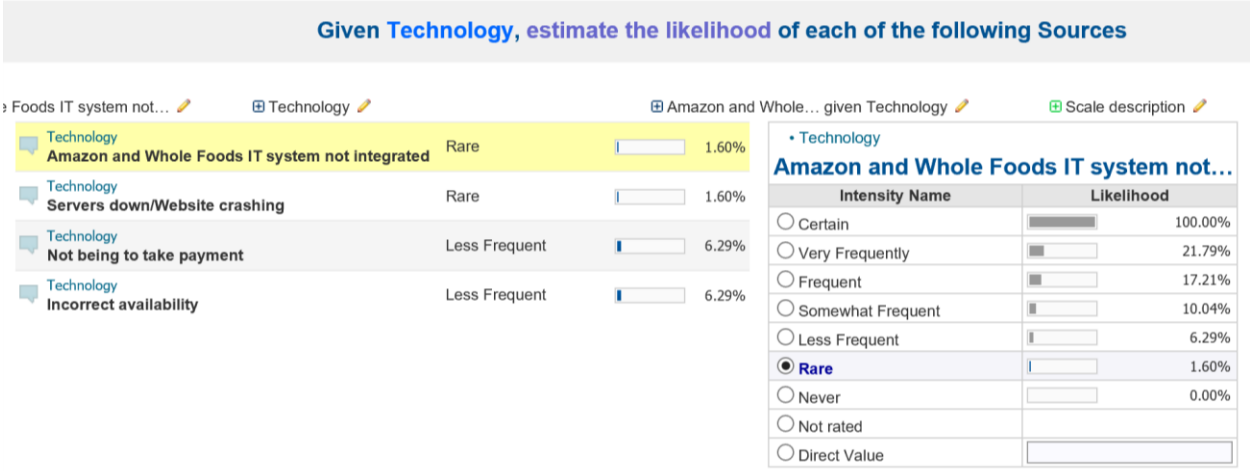
Another option for pairwise comparison, is the pairwise of probabilities method. Because participants typically do not know the probability of something happening, pairwise of probabilities allows the participant to compare the likelihood of different probabilities for a source or event. This method was selected for the Environmental category of sources, an area that participants were the least familiar with and therefore would have a harder time placing a judgement. The pairwise of probabilities method, asked participants to make multiple judgements between different probabilities of the source occurring, as seen in Figure 5.2. By comparing different probabilities, the participants were able to fine-tune their understanding and the judgement that resulted was more accurate.

Figure 5.2: Pairwise of Probabilities



The final measurement method utilized was a rating scale. Alternative to a traditional 1,2,3,4,5 rating scale that provides no information to the participant on the relative difference between the ratings, the Riskion rating scale utilizes likelihood percentages to allow the participant to make meaningful measurements. Riskion provided a variety of options for different rating scales, as well as the ability to make a custom rating scale. Figure 5.3 shows a custom rating scale created by the team for the Technology category of sources. This is a category where the team felt the likelihood of the sources would be very low, and therefore a default rating scale with options ranging from 0%-100% would not be as useful. To give the participant more options for selection in the low-likelihood range, the custom scale was created, and priorities were derived. The derivation of probabilities was done by the team utilizing a similar pairwise comparison method as discussed previously. Figure 5.3 shows that most options for selection are in the low-likelihood range.

Figure 5.3: Custom Rating Scale



5.2 Measurement Options

In addition to selecting measurement methods, Riskion provides customizable options to create a better experience for the participants. For example, clusters with many sub-sources or sub-objectives forces participants to make additional judgements to compare all of the possibilities. Riskion allows the number of comparisons to be refined by adjusting to a two-diagonal or one-diagonal comparison instead of having to complete all pairs of comparisons. The team had high confidence in the ability of the participants to make accurate measurements and determined that using reduced comparisons in certain areas was acceptable. Figure 5.4 shows a summary of options selected for the measurement of Sources.

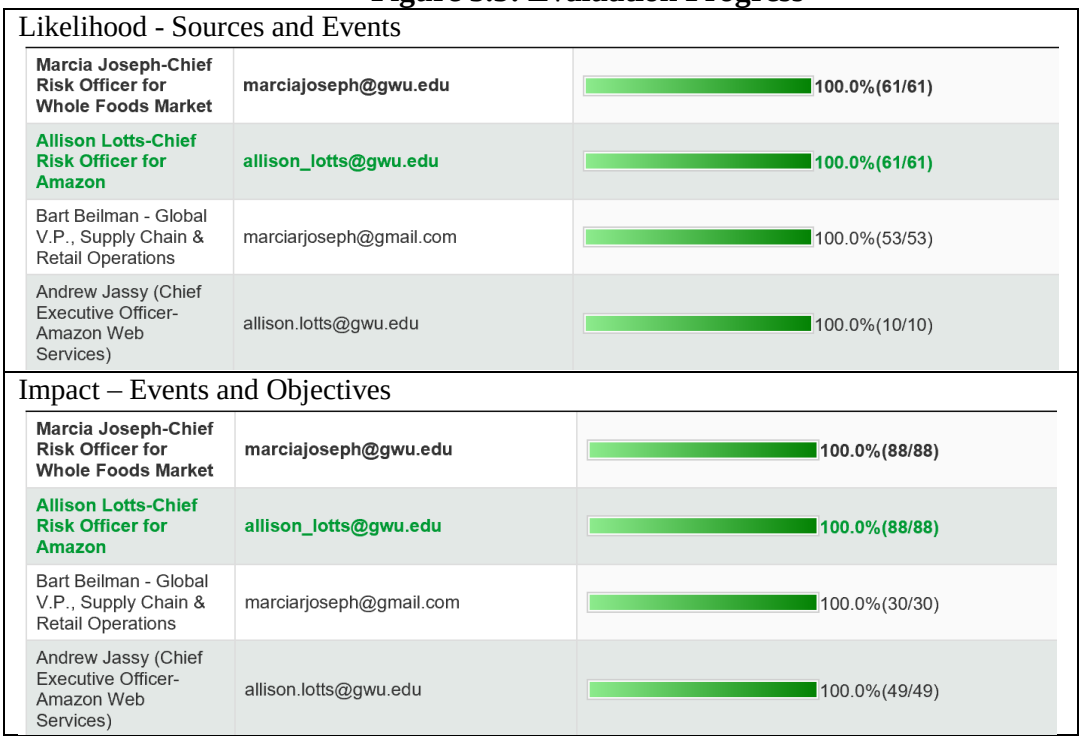
Figure 5.4: Measurement Methods and Options

Measure Likelihood	Measurement Type	Measurement Scale c	Action	# of Elements, # of Probabiliti	# of Judgments in Cluster	# of Comparisons Default: All pairs (maximum accuracy)	Display Default: One pair	Pairwise Typ Default: Verb
Sources	Pairwise Compari		Copy	5	(5-1)+(5-2)	Two diagonals	One pair	Verbal
Human Factor (Staffing ar	Pairwise Compari		Copy	4	4-1 = 3	One diagonal (lea	One pair	Verbal
Customer preference to								
Inadequately trained an								
Shortage of staff								
Changes to preferred cu								
Environmental	Pairwise of Probal	Default Pairwise of	Copy	2, 7	7*(7-1)/2 * 2	All pairs (maximum ac	One pair	Verbal
Produces out of season								
Contamination of produ								
Infrastructure/Inventory	Pairwise Compari		Copy	4	4*(4-1)/2 =	All pairs (maximum ac	One pair	Verbal
Storage freezer at not c								
Warehouse facilities not								
Lack of product quality								
Product unavailable								
Customer Service	Pairwise Compari		Copy	2	2*(2-1)/2 =	All pairs (maximum ac	One pair	Graphica
Lack of Inventory								
Bad reviews								
Technology	Rating Scale	Custom Scale for T	Copy	4	4			
Amazon and Whole Foo								
Servers down/Website c								
Not being to take payme								
Incorrect availability								
					Total 63			

5.3 Measuring Likelihood and Impact

Participant roles selected in Section 2.1 determined which judgements were required to be made by each participant. Upon completion of the measurement methods and options selection by the team, participants used Riskion to log in and place their judgements. Completion of the evaluations were tracked using evaluation progress. Figure 5.5 shows completion of all judgements by the participants for likelihood of sources and events, and impact on the objectives.

Figure 5.5: Evaluation Progress



6.0 Synthesis

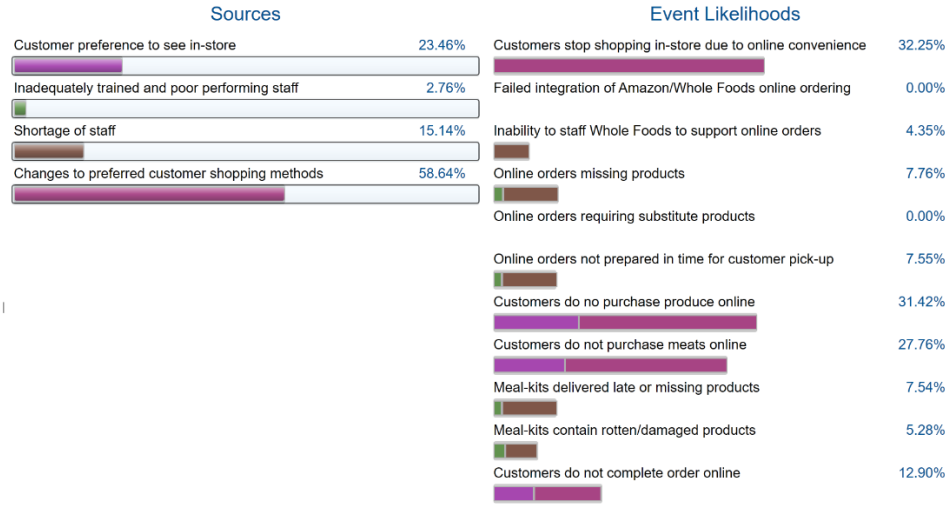
To determine if the judgements made by participants on the likelihood of events and sources, and the impacts of events on the objectives, were in accordance with what the intuitive results of the team should suggest, sensitivity analysis was performed to examine effects on the results as inputs are adjusted. The dynamic sensitivity analysis allowed the team to adjust the likelihood of sources to observe how that changed the likelihood of events. Additionally, it allowed observation of how changes to the priority of objectives adjusted the severity of the impact of events if they were to occur.

6.1 Likelihood

Dynamic sensitivity analysis was performed to observe how changes in the likelihood of sources adjusted the likelihood of events occurring. Figure 6 shows the overall results for the Human Factor source with no manipulation to any of the likelihoods and serves as a point of comparison. In this category the greatest likelihood of a source is in changes to preferred customer shopping methods which would create the greatest likelihood of the event that customers stop shopping in

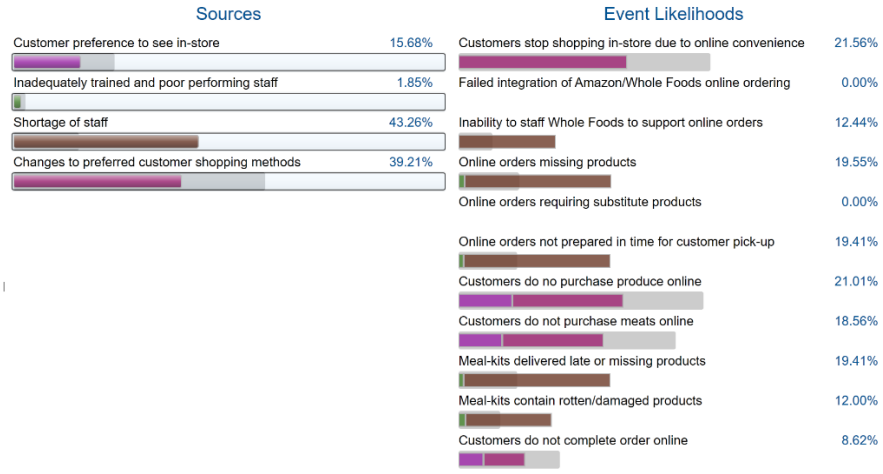
store due to online convenience, followed closely by customers not purchasing produce and meats online.

Figure 6: Dynamic Sensitivity – Human Factor Source with No Adjustments



When an adjustment is made to the likelihood of another source, such as shortage of staff, the likelihood of events adjusts accordingly based on the relationships created by judgements made by participants. As seen in Figure 6.1, as the likelihood of shortage of staff is increased, the events that are most likely to be triggered by that source are increased as well. It makes sense that these events, such as online orders missing products and online orders not prepared in time for customer pick-up would be more likely to occur as staffing becomes a bigger problem. The less staff you have available, the more likely it is for mistakes to be made because employees will be rushing to fill orders. It is also likely that there will not be enough employees to prepare orders in time. These relationships are in line with the results presented in the dynamic sensitivity analysis, and the results are therefore accepted.

Figure 6.1: Dynamic Sensitivity – Human Factor Source with Adjustments



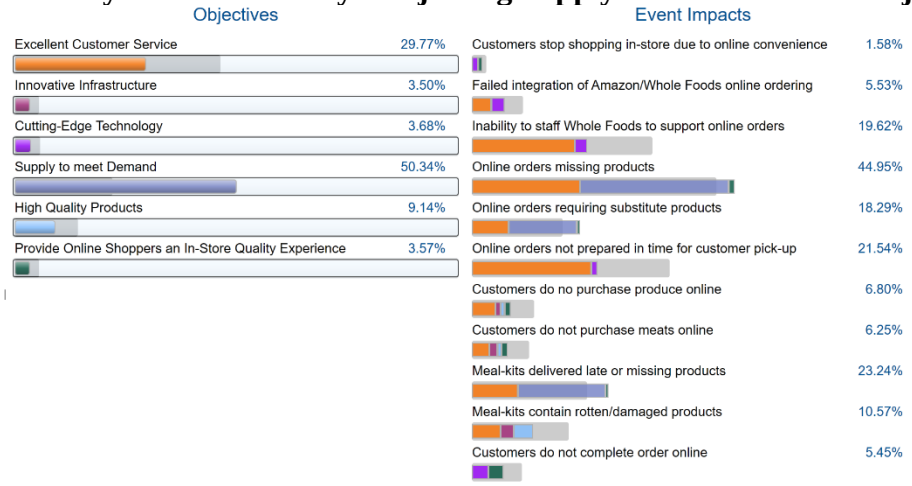
6.2 Impact

Dynamic sensitivity was also analyzed to see how changes in the priority of objectives resulted in changes to the impact of events. Figure 6.2 shows the overall results prior to any sensitivity analysis. It shows the risk event with the highest impact is online orders missing products, and it is tied most to the objectives of excellent customer service and supply to meet demand.

Figure 6.2: Dynamic Sensitivity – Overall Results with No Adjustments

By adjusting the priority of objectives and increasing the percentage of supply to meet demand, the impacts of risk events are adjusted accordingly, as seen in Figure 6.3. Because the event online orders missing products would cause a loss to the objective of supply to meet demand, by increasing this objective, the impact of the event is increased. Intuitively, this relationship makes sense and was accepted by the team.

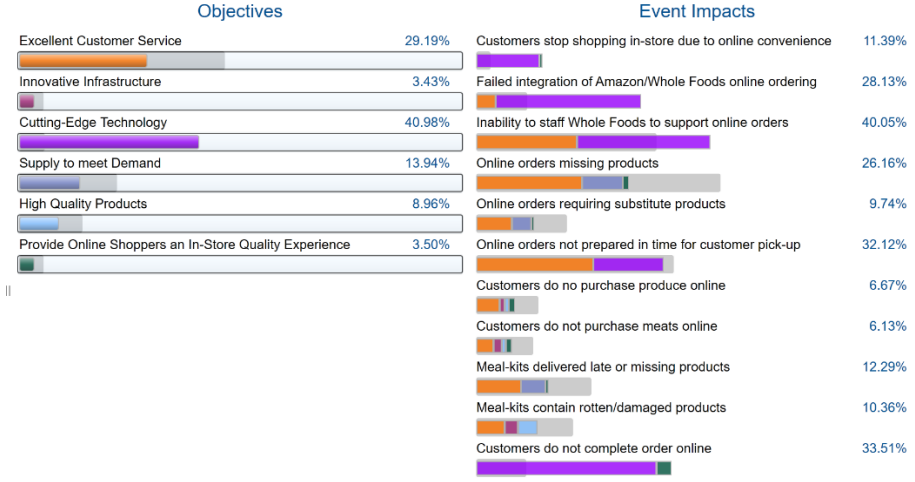
Figure 6.3: Dynamic Sensitivity –Adjusting Supply to Meet Demand Objective



If the priority of a different objective is adjusted, such as cutting-edge technology, other event impacts become greater, as seen in Figure 6.4. Online orders missing products becomes less of an impactful objective, and other events that result in a loss to the technology objective become more impactful. This is seen in events such as inability to staff to support online orders and

customers not completing orders online. Again, these relationships made sense to the team and supported the accuracy of judgements made by participants.

Figure 6.4: Dynamic Sensitivity –Adjusting Cutting-Edge Technology Objective



7.0 Overall Risk Results

Prior to identification of any controls, the risk results are shown in Figure 7. The judgements entered by the participants on the likelihood of events, and impact to the objectives were used to generate ratio scale measurements that were then mathematically meaningful and able to be multiplied. By looking at Figure 7 it can be seen that the simulated risk is a product of the likelihood multiplied by the impact. The total monetized risk, without controls, is $83.4M, and the average loss is about $56M. The simulated values are shown in the overall results instead of the computed values. This is because simulated values remove the potential that something was double counted. For example, there are multiple sources that could trigger the same event. Once a source has triggered that event, the simulated values remove the potential for another source to trigger the same event. This analysis assumes that once an event is triggered and a loss occurs, the event and corresponding loss cannot occur again.

Figure 7: Overall Results – No Controls

No. ▲	Event	All Participants Likelihood Computed	Likelihood Simulated	Impact, $ Computed	Impact, $ Simulated	Risk, $ Computed	Risk, $ Simulated
[04]	Customers stop shopping in-store due to online convenience	32.25%	31.30%	7,705,571	7,705,571	2,485,173	2,411,843
[06]	Failed integration of Amazon/Whole Foods online ordering	1.09%	0.90%	26,983,350	26,983,349	292,892	242,850
[07]	Inability to staff Whole Foods to support online orders	4.35%	4.60%	95,725,692	95,725,687	4,165,783	4,403,381
[08]	Online orders missing products	16.62%	15.20%	130,221,785	130,221,783	21,639,722	19,793,711
[09]	Online orders requiring substitute products	7.64%	6.90%	48,489,924	48,489,920	3,706,216	3,345,804
[10]	Online orders not prepared in time for customer pick-up	7.55%	7.50%	105,096,361	105,096,366	7,936,633	7,882,227
[12]	Customers do no purchase produce online	35.17%	29.00%	33,201,039	33,201,040	11,677,796	9,628,301
[13]	Customers do not purchase meats online	28.15%	21.90%	30,488,142	30,488,140	8,583,837	6,676,902
[15]	Meal-kits delivered late or missing products	12.99%	9.70%	61,154,791	61,154,793	7,945,760	5,932,014
[17]	Meal-kits contain rotten/damaged products	10.68%	7.90%	51,577,493	51,577,492	5,510,315	4,074,621
[18]	Customers do not complete order online	35.61%	16.10%	26,604,070	26,604,070	9,475,035	4,283,255
	Total Risk (Computed)					**$83,419,166**	
	Total Loss (Simulated)						**$56,145,982**

Each risk event in Figure 7 has a corresponding Bow-Tie diagram depicting the sources (or threats) that have the potential to influence the occurrence of the risk event, and the objectives that would be negatively impacted and experience a loss in the occurrence of that event. Each Bow-Tie diagram presents the likelihood of the source leading to the event, and the monetary impact of the event on the objective. These two values are multiplied to determine the monetary risk of that event. Figure 7.1 shows the Bow-Tie diagram for the risk event "Online orders missing products", the event with the highest risk.

Figure 7.1: Bow Tie Diagram – Online Orders Missing Products – No Controls

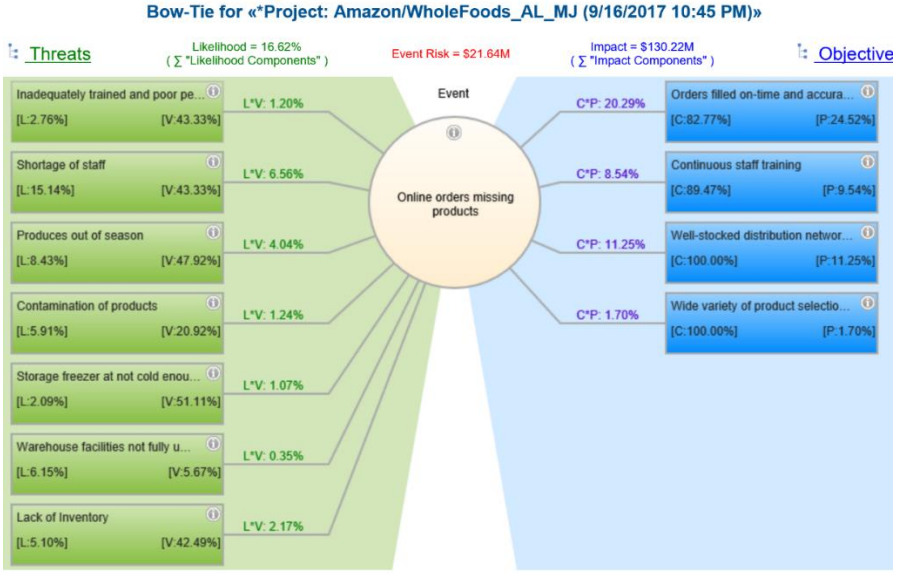
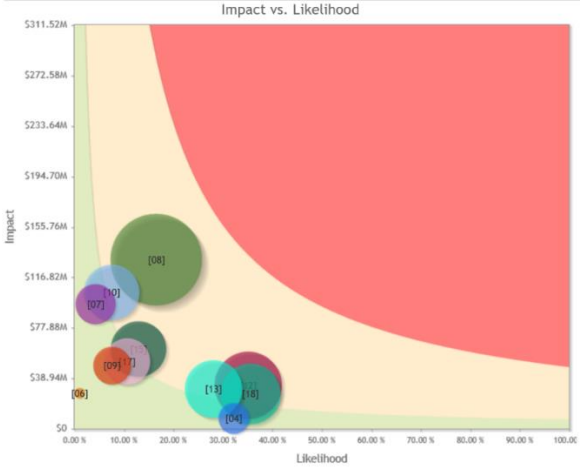


Figure 7.2 shows a heat map, without any controls applied, and visually presents which risk events are more likely and impactful than others. Risk Event number 8, "Online orders missing products", is clearly the event with the most risk, which we know to be true from the overall results and by looking at the individual Bow-Tie diagram. Section 8 will present controls that were identified and selected to apply to the risks, and it will be seen how application of those controls adjust the risk events and where they fall on the heat map.

Figure 7.2: Overall Heat Map Results – No Controls



8.0 Controls

8.1 Identifying Controls

To identify controls, the team brainstormed measures that could be taken to prevent an undesirable occurrence, reduce or maintain an acceptable level of risk. The team took a "Risk Reduction" approach to mitigate risk when identifying the controls. As an example, we identified the area of customer service as one of the areas where we would be prone to the most risk and we added proactive controls to prevent an event or source. We added a control of hiring 24/7 IT support to handle Amazon/Whole Foods specific issues apart from the average things customers purchased from the site. This staff that would assist in any technical issues would circumvent a customer from not completing their order. We also included training programs as well as offers such as gift cards for a bad shopping experience and gift cards for taking a survey for feedback. Figure 8 shows the final list of controls identified by the team. After identifying possible controls, we determined whether each control would apply to a threat (source), vulnerability (event), or consequence (impact of an event on an objective). In some cases, a control would be applicable to multiple areas. Additionally, the team determined the cost of applying each control. To determine the cost of each control we put all controls on an annual basis. For example, for the IT support team, we apportioned $175,000 for an IT support team to mitigate sources such as the website was showing incorrect availability or the site crashing. Figure 8.1 shows the final list of controls, their applicability, and the cost of each.

Figure 8: Identified Controls

Index	Control Name
01	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues
02	Daily testing of Amazon/Whole Foods data integration
03	Monthly internal inspections by regional manager
04	Connect with customers who had bad reviews and provide $25 gift card
05	Provide promotional products to provide positive reviews
06	Packaging to keep product fresh
07	Advertising campaign that focus on product quality
08	Provide free sample in online order or meal-kit
09	Recruiting initiatives
10	Offer $5 off next purchase to fill out customer survey (for 500 customers)
11	Staff teams in different regions to pair with local farms to build up product base
12	Agricultural expert to train staff
13	Ship products to customer's house that were unavailable to pickup in store
14	Product placement in Top Chef contestant challenge
15	Orientation/Training Program
16	Monthly internal inspections by regional manager
17	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues
18	Interactive tools for excellent online experience and enhanced product selection
19	Orientation/Training Program

Figure 8.1: Controls with Applicability and Cost

Index	Selected	Control Name	Control for	Cost	Applications
01	☑	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues	Threat	175000	4
02	☐	Daily testing of Amazon/Whole Foods data integration	Threat	7000	3
03	☑	Monthly internal inspections by regional manager	Threat	95000	4
04	☑	Connect with customers who had bad reviews and provide $25 gift card	Threat	100000	2
05	☑	Provide promotional products to provide positive reviews	Threat	100000	1
06	☐	Packaging to keep product fresh	Vulnerability	4200000	2
07	☐	Advertising campaign that focus on product quality	Vulnerability	1600000	9
08	☐	Provide free sample in online order or meal-kit	Vulnerability	1000000	7
09	☐	Recruiting initiatives	Vulnerability	500000	5
10	☑	Offer $5 off next purchase to fill out customer survey (for 500 customers)	Vulnerability	100000	4
11	☐	Staff teams in different regions to pair with local farms to build up product base	Vulnerability	1125000	5
12	☐	Agricultural expert to train staff	Vulnerability	100000	2
13	☑	Ship products to customer's house that were unavailable to pickup in store	Vulnerability	210000	2
14	☐	Product placement in Top Chef contestant challenge	Vulnerability	1200000	7
15	☑	Orientation/Training Program	Vulnerability	10000	5
16	☑	Monthly internal inspections by regional manager	Vulnerability	95000	4
17	☐	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues	Vulnerability	175000	8
18	☑	Interactive tools for excellent online experience and enhanced product selection	Consequence	15000	6
19	☑	Orientation/Training Program	Consequence	600000	9

8.2 Measuring Controls

We determined the efficiency of each control by going through and adding a value from 0 to 1 for the percentage we expected the control to reduce the risk (ex: 0.4 meant we thought the control would fix 40% of the risk occurring) then applied our best judgement. For the IT support team, the effectiveness of mitigating those risk with the additional staff was determined to be 90%. Figure 8.2 shows the measures of effectiveness applied to each control.

Figure 8.2: Controls with Effectiveness

ID	Control Name	Selected	Control for	Cost	Application count	Application	Effectiveness
1	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues		Threat	175,000	4	Amazon and Whole Foods IT system not integrated Servers down/Website crashing Not being to take payment Incorrect availability	90.00 90.00 90.00 75.00
2	Daily testing of Amazon/Whole Foods data integration	Yes	Threat	7,000	3	Incorrect availability Servers down/Website crashing Amazon and Whole Foods IT system not integrated	5.00 5.00 5.00
3	Monthly internal inspections by regional manager		Threat	95,000	4	Storage freezer at not cold enough Warehouse facilities not fully up to code for safety regulations Lack of product quality Contamination of products	50.00 20.00 50.00 50.00
4	Connect with customers who had bad reviews and provide $25 gift card	Yes	Threat	100,000	2	Bad reviews Inadequately trained and poor performing staff	75.00 75.00
5	Provide promotional products to provide positive reviews		Threat	100,000	1	Bad reviews	50.00
6	Packaging to keep product fresh		Vulnerability	4,200,000	2	Lack of product quality / Meal-kits contain rotten/damaged products Contamination of products / Meal-kits contain rotten/damaged products	75.00 75.00
7	Advertising campaign that focus on product quality		Vulnerability	1,600,000	9	Changes to preferred customer shopping methods / Customers stop shopping in-store due to online convenience Customer preference to see in-store / Customers do no purchase produce online Changes to preferred customer shopping methods / Customers do no purchase produce online Changes to preferred customer shopping methods / Customers do not purchase meats online Lack of product quality / Customers do not purchase meats online Lack of product quality / Customers do no purchase produce online Bad reviews / Customers do not complete order online Customer preference to see in-store / Customers do not complete order online Changes to preferred customer shopping methods / Customers do not complete order online	40.00 30.00 30.00 30.00 10.00 10.00 30.00 30.00 30.00

8.3 Selecting Controls

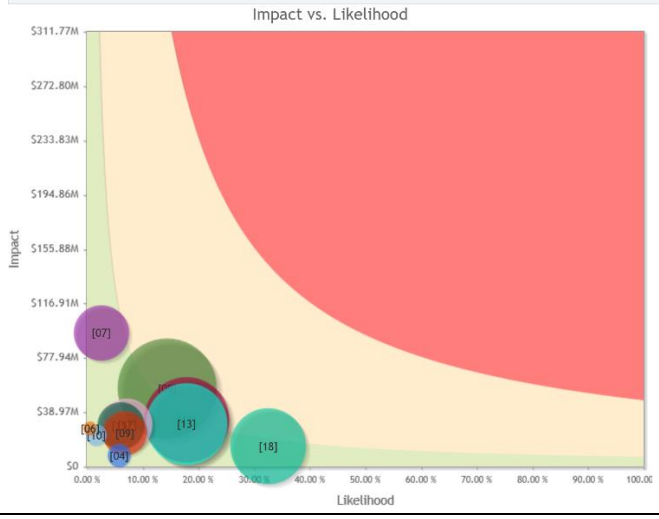
To select and apply controls, the team had to first determine a budget that would be available to allocate toward desired controls. For the team's initial risk analysis using selected controls, the selected budget was $1.5M. Further scenarios are discussed in Section 8.4. Multiple methods could be used in Riskion to determine the best selection of controls. Best judgement can be used by participants, stand-alone or SA reduction can be used to sort the controls by those that reduce the most risk, or the software optimization tool can be used to calculate the most optimal selection of controls with the budget provided. The team determined the optimization method was the best for this analysis, which allowed 10 controls to be selected, which reduced the total risk from $83.4M to $52.4M, a $31M reduction. Figure 8.3 shows the overall simulated risk with the selected controls applied.

Figure 8.3: Overall Results – With Controls

No. ▲	Event	All Participants Likelihood Computed	Likelihood Simulated	Impact, $ Computed	Impact, $ Simulated	Risk, $ Computed	Risk, $ Simulated
[04]	Customers stop shopping in-store due to online convenience	4.84%	31.40%	7,705,571	7,705,571	372,776	2,419,549
[06]	Failed integration of Amazon/Whole Foods online ordering	0.16%	0.40%	26,983,350	26,983,349	42,625	107,933
[07]	Inability to staff Whole Foods to support online orders	4.35%	5.90%	95,725,692	95,725,687	4,165,783	5,647,815
[08]	Online orders missing products	14.38%	12.70%	94,279,375	130,221,783	13,555,421	16,538,166
[09]	Online orders requiring substitute products	6.82%	7.20%	36,380,590	48,489,920	2,479,793	3,491,274
[10]	Online orders not prepared in time for customer pick-up	6.71%	7.40%	65,171,800	105,096,366	4,372,880	7,777,131
[12]	Customers do no purchase produce online	30.68%	28.90%	33,201,039	33,201,040	10,184,507	9,595,100
[13]	Customers do not purchase meats online	24.10%	22.10%	30,488,142	30,488,140	7,346,228	6,737,879
[15]	Meal-kits delivered late or missing products	8.01%	8.80%	45,975,654	61,154,793	3,683,371	5,381,621
[17]	Meal-kits contain rotten/damaged products	7.19%	7.50%	41,966,331	51,577,492	3,018,777	3,868,311
[18]	Customers do not complete order online	21.81%	15.80%	14,434,899	26,604,070	3,148,550	4,203,443
	Total Risk Reduction (Computed)					**$31,048,450**	
	Total Residual Risk (Computed)					**$52,370,716**	
	Total Loss Reduction (Simulated)						**$3,696,101**
	Total Residual Loss (Simulated)						**$52,449,880**
	Cost of Selected Controls						**$1,500,000**

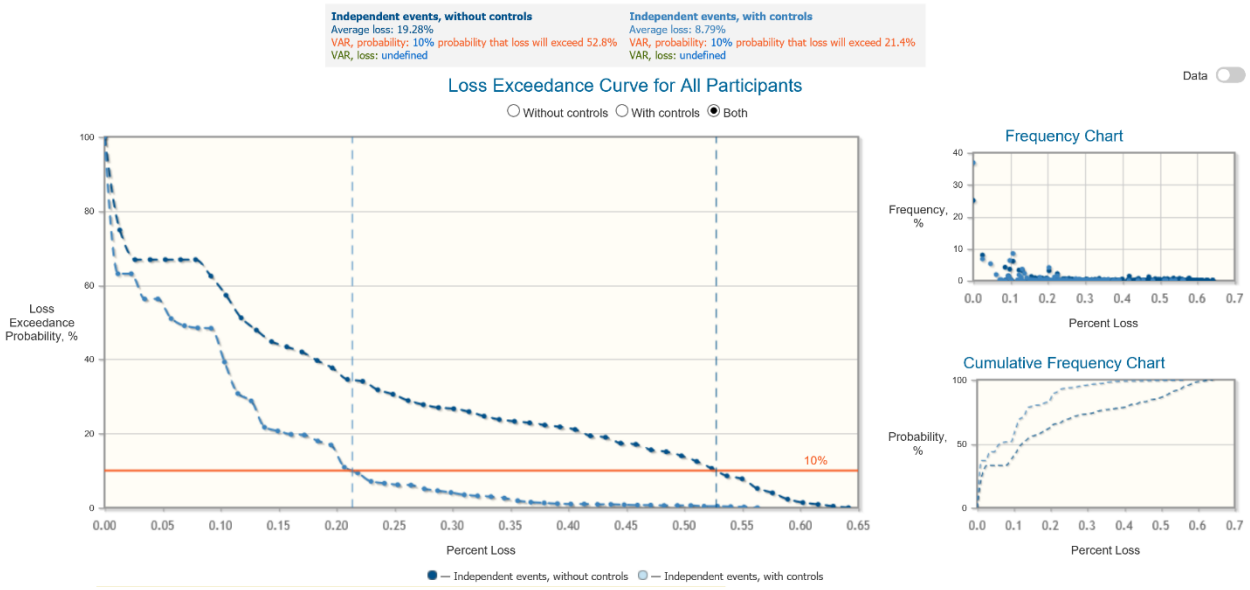
Utilizing the same tools as the team did prior to the application of controls, the heat map can be seen showing the overall reduction in the total risk of each event (see Figure 8.4). All events shifted down and/or to the left showing effectivness of the controls selected.

Figure 8.4: Overall Heat Map Results – With Controls



To determine if the selected controls were sufficient enough in reducing risk to the desired amount, the Loss Exceedance Curve was analyzed. Shown in Figure 8.5, this curve shows results with and without controls applied and calculates the probability of a percent loss. For example, under the current control scenario of $1.5M applied to the optimized selection of controls, there is a 10 percent probability that the loss will exceed 21.4 percent. This is an improvement over a 10 percent probability of the loss exceeding over 50 percent without the controls applied. This analysis allows the adjustment of probability levels based on the decision-makers risk tolerance. If there was a need to be more secure, the setting could be adjusted to a 5 percent probability which would show the loss could almost exceed 30 percent. If that loss percentage is too high, the decision-makers may allocate additional budget to apply additional controls. Additional budget scenarios are presented next.

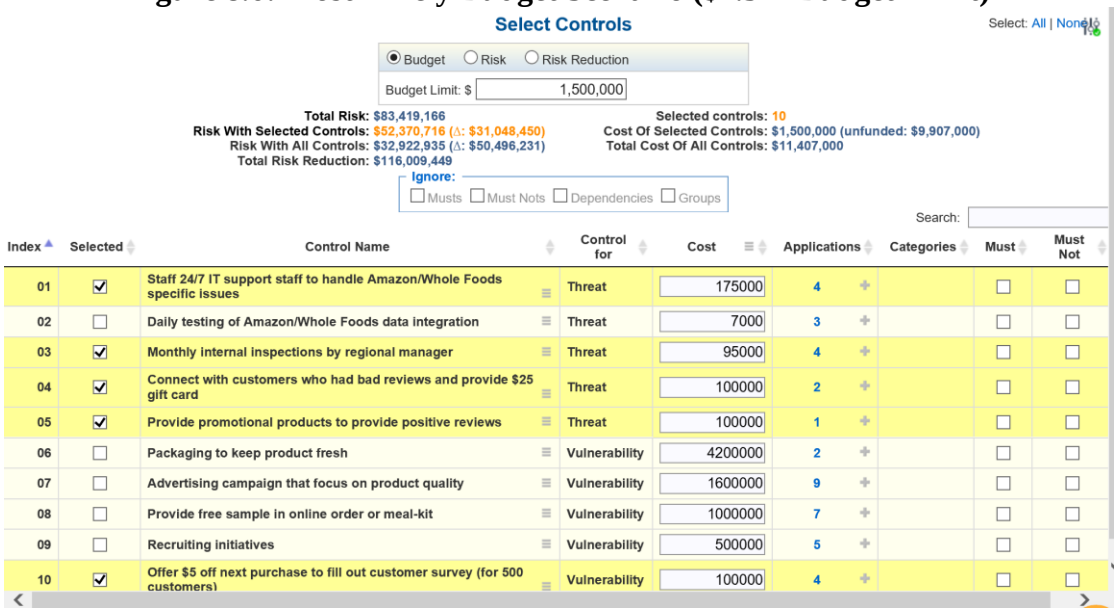
Figure 8.5: Loss Exceedance Curve – With Controls



8.4 Scenarios

Because the availability of resources for risk mitigation can vary based on organizational objectives and strategies for reducing risk, three scenarios were used with different available budgets. The scenarios selected were: a best-case budget with $2M available, a most-likely budget with $1.5M available, and a worst-case budget with $1M available. These amounts were separately entered in the budget limit, and controls were then optimized to allow the software to calculate the best selection of controls with the resources provided. Figure 8.6 shows an example of the most-likely budget scenario. By applying $1.5M, 10 controls were selected, and the total risk was reduced from $83.4M to $52.4M, about a $31M reduction.

Figure 8.6: Most-Likely Budget Scenario ($1.5M Budget Limit)



Select Controls

Select: All | None

Budget | Risk | Risk Reduction

Budget Limit: $ 1,500,000

Total Risk: $83,419,166
Risk With Selected Controls: $52,370,716 (Δ: $31,048,450)
Risk With All Controls: $32,922,935 (Δ: $50,496,231)
Total Risk Reduction: $116,009,449

Selected controls: 10
Cost Of Selected Controls: $1,500,000 (unfunded: $9,907,000)
Total Cost Of All Controls: $11,407,000

Ignore: Musts | Must Nots | Dependencies | Groups

Search:

Index	Selected	Control Name	Control for	Cost	Applications	Categories	Must	Must Not
01	☑	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues	Threat	175000	4		☐	☐
02	☐	Daily testing of Amazon/Whole Foods data integration	Threat	7000	3		☐	☐
03	☑	Monthly internal inspections by regional manager	Threat	95000	4		☐	☐
04	☑	Connect with customers who had bad reviews and provide $25 gift card	Threat	100000	2		☐	☐
05	☑	Provide promotional products to provide positive reviews	Threat	100000	1		☐	☐
06	☐	Packaging to keep product fresh	Vulnerability	4200000	2		☐	☐
07	☐	Advertising campaign that focus on product quality	Vulnerability	1600000	9		☐	☐
08	☐	Provide free sample in online order or meal-kit	Vulnerability	1000000	7		☐	☐
09	☐	Recruiting initiatives	Vulnerability	500000	5		☐	☐
10	☑	Offer $5 off next purchase to fill out customer survey (for 500 customers)	Vulnerability	100000	4		☐	☐

This most-likely scenario was incrementally better at reducing risk than the worst-case scenario with a budget of $1M. In the worst-case scenario, the optimized controls reduced the total risk to $55.5M, about a $28M reduction to total risk. This shows that by allotting an additional $0.5M toward application of controls, the total risk was reduced by an additional $3M. If the budget scenario was increased to the best-case of $2M available, the total risk is reduced to $50.2M, an incremental reduction of just over $2M to total risk. Because an additional $0.5M in this case only reduced the risk by an additional $2M, this would suggest that there are diminishing reductions to total risk the more funding you apply to controls. To test this theory, a fourth scenario was run with a budget limit of $2.5M. This scenario allows almost all controls to be selected. However, by applying an additional $0.5M on top of the best-case budget scenario, total risk is reduced by an additional $4.9M. This increase in incremental risk reduction suggests the additional budget enabled the application of an outlying control that if able to be funded could contribute to risk reduction. However, to continue to test the theory of diminishing returns and additional case of $3M was considered, which resulted in only $0.9M incremental risk reduction, thus confirming the theory. These results are summarized in Figure 8.7, and show that applying the same amount of incremental funding, does not yield the same incremental reduction in risk, and in fact, the benefits to risk reduction are diminished as more resources are applied to controls. This is because the most impactful controls are selected during optimization, leaving the less impactful controls to be selected as more resources become available. Decision makers must decide what is the best application of their resources based on their risk reduction goals. Running multiple scenarios can provide these decision makers options for consideration.

Figure 8.7: Budget Scenarios

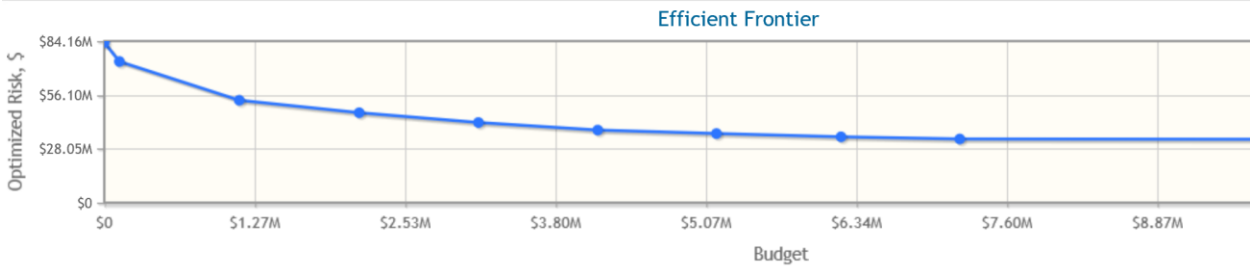
Scenario	Budget Limit	Total Risk (before controls)	Total Risk (post controls)	Risk Reduction	Incremental Risk Reduction
Worst-Case	$1.0M	$83.4M	$55.5M	$27.9M	N/A
Most-Likely	$1.5M	$83.4M	$52.4M	$31.0M	$3.1M
Best-Case	$2.0M	$83.4M	$50.2M	$33.3M	$2.3M
Beyond Best-Case A	$2.5M	$83.4M	$45.3M	$38.2M	$4.9M
Beyond Best-Case B	$3.0M	$83.4M	$44.3M	$39.1M	$0.9M

8.5 Optimization and Efficient Frontier

The concept of diminishing returns that was tested in the previous scenarios, is presented in the software model under the Efficient Frontier. Instead of testing different budget scenarios for the most optimized combination of controls that most effectively reduces the risk, the efficient frontier presents data points that represent increasing budgets and how the risk with selected controls is reduced as more budget is applied. As shown in Figure 8.7, the earlier application of funding results in a greater amount of risk reduction than later application of funding. As discussed in Section 8.4, this is due to the software optimizing the use of the budget to select the controls most effective at reducing risk before those less effective. Management can use this tool to evaluate the best point on the curve to select the most optimum combination of budget and risk reduction that satisfies management's risk reduction objectives.

Figure 8.7: Efficient Frontier

Index	Events/Budget	$0	$137,000	$1.15M	$2.15M	$3.16M	$4.16M	$5.21M	$6.21M
	Risk with Selected Controls	26.76	23.6	17.12	15.04	13.4	12.14	11.56	11.01
	Funded Cost	$0	$127,000	$1.14M	$2.15M	$3.15M	$4.16M	$5.16M	$6.21M
1.	Staff 24/7 IT support staff to handle Amazon/Whole Foods specific issues								FUNDED
2.	Daily testing of Amazon/Whole Foods data integration		FUNDED	FUNDED	FUNDED	FUNDED	FUNDED	FUNDED	FUNDED
3.	Monthly internal inspections by regional manager		FUNDED	FUNDED	FUNDED	FUNDED	FUNDED	FUNDED	FUNDED
4.	Connect with customers who had bad reviews and provide $25 gift card			FUNDED	FUNDED	FUNDED	FUNDED	FUNDED	FUNDED
5.	Provide promotional products to provide positive reviews						FUNDED		FUNDED
6.	Packaging to keep product fresh								
7.	Advertising campaign that focus on product quality							FUNDED	FUNDED



9.0 Conclusion

Through the thorough analysis of the risk management team and their selected participants, events and sources were identified and measured to determine the likelihood of occurrence. Objectives were structured and the impact of loss was measured to determine overall risk based on the identified sources and events. An analysis was completed to make certain that judgements and measurements were in line with the intuition of the team. To reduce the likelihood and impact of the uncertain loss, controls were identified, measured, and selected. An analysis of the adjusted risk was completed to present multiple scenarios. The team has determined that due to the diminishing return of additional funding allocated to the application of controls, management should utilize the "most-likely" scenario. If decision-makers are less risk tolerant and determine there is additional funding available, then more funding can be applied to capture those additional incremental reductions in risk.