EMD Millipore – Sustainable Packaging Assessment

Project Overview
EMD Millipore, a Massachusetts-based life sciences company, recently launched a customized, renewable packaging pilot program in response to growing customer demand for non-cardboard packaging solutions. After conducting a life-cycle analysis (LCA) of the pilot program, however, EMD found the carbon footprint of the renewable packaging to be higher than expected, due to the additional trips needed to return the packaging from the customer site back to EMD’s facilities. Furthermore, the customized nature of the packaging and the additional logistical complexity involved resulted in the cost of the renewable packaging program being higher than anticipated. In its current form, therefore, it would not be financially nor operationally sustainable to expand this program to additional customers.

EMD has engaged our Sustainability Lab project team to address the following:

1. Evaluate the reusable totes program from a financial, operational and environmental sustainability perspective
2. Develop qualitative and quantitative decision-making tools to help EMD identify optimal packaging choices by product/customer
3. Review existing literature and identify best practices for consideration in future packaging initiatives
4. Provide organizational recommendations to effectively incorporate environmental sustainability considerations into the packaging process, and to make sustainability efforts a key driver of innovation for EMD as a whole

This report provides a detailed account of our analysis as well as our findings and recommendations, which we believe will assist EMD in identifying a scalable packaging solution and in positioning the corporate responsibility (CR) team to lead innovation efforts at the company.

Company Background
EMD Millipore is a life sciences company headquartered in Billerica, Massachusetts. Originally founded in 1954, it was recently acquired in 2010 by Merck KGaA, a global pharmaceutical and chemical company with revenues of approximately €11 billion (in 2012) and over 40,000 employees. EMD is comprised of three main business areas: Bioscience, Lab Solutions and Process Solutions. It supplies a wide variety of products to lab and production customers in industries ranging from academia and government to pharmaceutical and consumer staples. EMD is a global firm with customers located in the United States, Europe and Asia.

Sustainability in the Life Sciences Industry
Manufacturers in the life sciences industry have the challenging task of transporting heavy, expensive and fragile products across long distances in order to meet the needs of their primary customers, large pharmaceutical companies. As a result, the majority of the packaging used in this industry is designed primarily to protect and ensure the sterility and safety of its contents, preferably with as little cost as possible. The most common packaging approach is to individually wrap products in plastic and corrugated cardboard, which is then disposed of at the customer site after each delivery.
While corporate social responsibility has been gaining momentum in the pharmaceutical industry, putting some pressure on life sciences manufacturers to improve their sustainability, our interviews with operations professionals in the industry indicate that concerns about the sustainability and reusability of packaging is simply not part of the industry culture:

"The challenge is that the pharmaceutical industry does not have a culture of reusability, so facilities managers are not used to thinking about what happens to packaging after the product is removed. Companies have recycling facilities for cardboard, but are not usually equipped to handle the inventory and logistics of reusable packaging. This will require a significant change in behavior." - Christian Lim, Biogen Idec

However, in addition to generating significant materials waste, corrugated cardboard packaging has another downside: the particulate from the packaging can contaminate clean room facilities, and the cardboard itself is prone to mold and other sanitation issues. Furthermore, the individually-wrapped products take significantly longer to unload and unpack at the customer site, and require de-contamination and a separate transfer to a clean room facility. This is causing a major shift in the industry, as pharmaceutical companies are now requesting suppliers to provide reusable plastic packaging in order to reduce contamination potential and lower the amount of labor required to unpack and transport the products at the customer site.

EMD Sustainability Challenge
This shift in customer preference was the primary driver of EMD’s reusable plastic totes pilot program, which was implemented to satisfy requests from a couple of large customers, and to determine whether this new packaging solution could be scaled up to more customers. As part of a broader effort to lead a more comprehensive initiative on sustainable packaging throughout the company, EMD has experimented with numerous ways of reducing packaging-related waste such as replacing poly-foam with corrugated inserts and reducing/simplifying material handling. However, the reusable plastic totes program was an even larger undertaking, and required coordination across multiple areas of EMD, including procurement, packaging, logistics and sales.

Economic and Logistical Challenges
One major challenge from a cost perspective was the fact that EMD was not able to identify any off-the-shelf reusable packaging solutions that were suitable for the expensive, heavy and fragile equipment that they were shipping to customers. As a result, the packaging had to be developed in-house at EMD, which required a significant investment of both time and resources. In addition, the totes weigh significantly more than the cardboard packaging, and this extra weight contributes to increased costs along all aspects of transportation. Addressing these economic challenges would be critical to making the business case for an increased roll-out of the reusable totes program.

After the packaging had been developed, an additional logistical challenge emerged - the new packaging system required the totes themselves to be returned to EMD in order to be reused. For the customers, this was a significant shift from the status quo of simply disposing of the packaging at the customer site. This extra travel leg required additional coordination between EMD and its customers, to track and organize shipping of the empty totes, which quickly became a burdensome process. Without a robust tracking system in place, it was often difficult for EMD to know how many totes were at each warehouse, customer site or distribution facility at any given point in time.
An additional, unforeseen challenge has been the reluctance of EMD’s customers to share totes between themselves, for fear of contaminating their production suite with foreign chemicals. Although it is somewhat manageable to keep totes unique between two customers, scaling this solution to EMD’s wider customer base may be difficult without a system in which totes can be shared among customers.

Sustainability Challenges
Interestingly, because the new reusable packaging initiative was driven by customer demand rather than an internal sustainability strategy, the CR team was not directly involved in the original design and roll-out of the program. However, the CR team was recently involved in assessing the environmental sustainability of the pilot program by conducting a life cycle assessment (LCA) of the totes program, with a focus on CO₂ emissions. The LCA result was surprising: the CR team concluded that the reusable tote program in its current form is actually more harmful to the environment than the corrugated cardboard packaging, when considering the lifecycle from production through end use (but excluding disposal). Due to their reusable nature, the totes initially appeared to be less harmful to the environment than the disposable corrugated material, but this gain was negated by the extra travel required to return the totes back to the distribution center, or to EMD directly. The bulk of this program’s carbon footprint was related to transportation, and as a result, the reusable totes fared poorly in this regard relative to disposable cardboard packaging.

The result of the LCA has put the CR team in a difficult position: on one hand the reusable totes have been a success from a customer satisfaction perspective, but on the other, it is clear that expanding the pilot program in its current form may not be justifiable from an economic, logistical, or environmental standpoint.

Reusable Totes Program Analysis
After studying the LCA on our first call with EMD, we determined that the initial focus of our project would be to analyze the reusable totes pilot program in order to identify (1) whether adjustments could be made to the current totes program to make its scale-up feasible, and (2) whether alternative packaging solutions could meet customer needs in an economically, logistically and environmentally sustainable way. The CR team at EMD Millipore played an essential role in our data collection process. We conducted interviews with eight key stakeholders throughout the organization, including packaging engineers, account managers, and logistics staff. Each of these individuals had been directly involved in the totes pilot program, and was able to provide significant insights about the program itself and sustainability efforts at EMD more generally. Our S-Lab classmates were an additional resource, providing both packaging and industry knowledge, as well as the customer (pharmaceutical company) point of view.

Qualitative Scorecard Tool
Based on the challenges of the reusable totes program relative to other packaging options, it was clear that a framework comparing the costs and benefits of various options would be useful for EMD in its packaging decision-making process. Using the vast amount of qualitative information we gathered during our interviews, we identified four key criteria that could be used to evaluate different packaging solutions:

- **Ease of Use** – This criteria captures the customer preference for packaging that is easy to unpack (fewer labor hours required) and that does not create contamination risks or sanitary issues within a clean room facility.
Cost – This refers to the economic cost of the packaging itself as well as any other packaging-specific costs (additional labor/shipping, disposal, etc.).

Logistics – This reflects a high-level measurement of the logistical complexity required to use the packaging, which is influenced by factors such as tracking, warehousing, coordinating return trips, etc.

Sustainability – The key sustainability metric for the purposes of this analysis is CO₂ emissions.

These criteria form the foundation for our Qualitative Scorecard, which is designed to compare various packaging solutions across these four dimensions. Through our interviews we identified the four most likely packaging solutions that a life sciences company such as EMD might consider:

Reusable Plastic Tote – This represents the current reusable plastic totes being used in the pilot program, and is therefore considered to have higher financial costs and more complex logistics, relative to non-reusable options. The plastic totes also reduce the number of products shipped per truckload due to the larger size of the packaging.

Corrugated Cardboard – This is the most common packaging solution in the industry, in which products are individually packaged in corrugated cardboard boxes and plastic wrap. This solution is cost-effective, as the materials are cheap and relatively lightweight, requiring less capital investment and allowing for more product shipments per truck. However, corrugated cardboard produces a significant amount of material waste that may or may not be recycled at the customer site. Furthermore, customers are moving away from this solution due to the challenges related to unpacking cardboard and potentially contaminating the facility.

Bulk Shipping – This option uses corrugated cardboard as well, but consolidates individual products into larger bulk packages, which uses fewer material and is easier for customers to unpack. However, bulk shipping can only be used for orders of a certain volume and may therefore be limited in its applicability across various customers and products.

Non-Cardboard Disposable – This solution is not currently used by EMD, but is a potential option to explore, as it may resolve some key customer concerns with the cardboard packaging while having a lower environmental impact than plastic reusable totes. In addition to reducing the logistical complexity associated with the reusable totes, this packaging would ideally be easier for customers to unpack, and would not contribute to potential contamination.

EMD is seeking to identify the best packaging solutions for its customers in a way that is as scalable, economical, and environmentally sustainable as possible. Unfortunately, each existing packaging option does not appear to meet all of these criteria; there appears to be a trade-off between the different characteristics, and no “clear winner” across all categories.

Our goal was to provide EMD with a decision tool to help determine the most viable packaging solution(s), based on a variety of factors. The first decision tool we created is a Qualitative Scorecard (QS), intended to rank each of the potential packaging solutions relative to one another across the four key categories that were identified. The QS provides a visual representation of the limitations of each packaging option, and provides some direction as to where improvements may be made (see next page).
Key Findings and Recommendations from Qualitative Scorecard

Using our qualitative scorecard as a guide, we propose the following recommendations, which we believe EMD should consider in order to improve the effectiveness of the reusable totes program and to make it a potentially viable solution.

Finding #1: Reusable totes are preferred by certain customers, but the economic costs of the packaging prevent a further rollout of this program from being financially feasible.

Recommendation #1: Focus efforts on improving the cost-effectiveness of reusable totes

- Work with packaging specialists to identify potential off-the-shelf reusable tote solutions. One of the primary reasons for the higher costs of the reusable totes program is the fact that no off-the-shelf packaging solution has been identified that can be purchased by EMD in bulk, resulting in a higher cost per unit than would be achieved with an existing off-the-shelf solution. While EMD has already investigated the potential for an off-the-shelf solution, based on our interviews with packaging specialists we believe that there may be opportunities to modify existing packaging solutions to suit EMD products. EMD should initially focus on a packaging solution that would accommodate the highest volume products in order to achieve economies of scale. We have identified several firms that offer reusable...
packaging solutions (such as Orbis Corporation) as well as customizable solutions (such as Buckhorn Inc.), which may offer EMD a way to source reusable packaging at an affordable price.

- **Stay up to date on developments in reusable packaging; engage with the industry to move towards a standardized solution.** While there may not yet be an existing off-the-shelf solution for EMD, it is clear that customer demand is moving in the direction of reusable/plastic totes due to the value-add of this type of packaging for the customer. As a result, we believe that suppliers in the industry (EMD and its competitors) will also be moving toward this type of packaging. As a critical mass forms there are likely to be more off-the-shelf options developed by companies meeting this growing demand. One way to stay current on new developments in this area would be to engage with the Reusable Packaging Association, which has a free newsletter providing updates on reusable packaging innovations (EMD may also become a member of this association for a price of $1,500 per year). Another potential resource is the Reusable Industrial Packaging Association (RIPA). In the longer term, developing a consortium among suppliers could provide the economies of scale necessary for an off-the-shelf solution.

**Finding #2:** EMD has difficulty tracking the precise location of the totes at any particular moment in time.

**Recommendation #2:** Use RFID chips to track the individual totes in real time. By attaching a relatively cheap tracking device on each reusable tote, EMD and its customers would be able to identify the exact location of each tote, and have a better sense of when the tote stock is running low at a certain location, or when inventory has built up and needs to be relocated. The RFID chips would also allow EMD to gather data over time to see how an individual tote travels to and from customers. This could lead to further insights on the logistical optimization of the totes program.

**Finding #3:** Customers do not always return the totes in a timely manner, and are not significantly invested in the efficiency of the system. Furthermore, the logistical challenges are causing the environmental impact to be larger than necessary.

**Recommendation #3:** Work with customers to get buy-in for the system. Given that some of the recommended sustainable packaging options will require substantial changes in the way that EMD and its customers currently operate, a key determinant of success will be the extent to which the customer agrees with the initiative and believes in its design. For both of EMD’s current sustainable packaging pilot programs, the customer is paying a higher price for the product ($6 more for each unit), however the program was not designed or structured as a joint investment between EMD and the customer.

EMD is currently struggling with the fact that customers are not returning empty totes in a timely manner, and often send the totes back without the corresponding pallet or vice versa. This makes deliveries back to the customer difficult, as EMD may not have the proper ratio of totes to pallets at their facility due to the inconsistency of the returns.

Since any sustainability initiative involving packaging will require customers to change their expectations or behavior, it will be very important for EMD to attain complete customer buy-in. This is especially the case if a new initiative will be logistically challenging, and because the concept of reusable containers is
foreign to an industry that has always prioritized use-and-throw practice to ensure against contamination. Due to the nature of the pharmaceutical industry, sustainability initiatives alone are not likely to win EMD more business or new customers. It will therefore be imperative for EMD to make sure that a sustainability initiative benefits its customers as much as it does EMD.

Furthermore, due to the sheer variety of EMD’s product line and the geographical diversity of its customer’s facilities, it will not be possible to continue designing customized sustainable packaging solutions in the small-scale, fragmented way that it has through the current tote pilot program. It will therefore be important for EMD to clearly and convincingly communicate to its customers that it has designed a standardized program with the aim of scaling it across as many customers as possible.

Finding #4: There has not been significant follow-up with customers after launching the initial two pilot programs (or there has been follow-up, but it has not been communicated to groups across EMD).

Recommendation #4: Engage regularly with the customer to solicit feedback on the totes pilot program, and ensure that this information is disseminated to anyone who will be involved in designing future packaging programs. Customer feedback from the pilot programs is essential for determining the effectiveness of the current solution and identifying areas for improvement. Regular conversations with the customers would allow EMD to have real-time feedback and would strengthen customer relationships. This constant contact would also increase customer engagement with the system, and create a reliable point of contact for EMD to reach out to when issues arise around the returning of totes.

Quantitative Decision Tool (Excel Model)
The second main deliverable we created for EMD is a quantitative, Excel-based decision tool. This decision tool is designed to be customer and product specific, and will allow EMD to view the total economic cost and environmental impact for each packaging option based on a given customer and product scenario. For example, the reusable totes program may be optimal for a customer in New Hampshire ordering filters, while bulk cardboard shipping may be optimal for a customer in California ordering filters. In order to provide these outputs, the decision tool is populated with several variables that impact the economics and the environmental impact, ultimately leading to the optimal packaging solution from either perspective.

The tool consists of a front-end “Data Input” tab, with the following input fields to be filled in for the specific customer/product scenario being tested:

- **Customer** – a drop-down list of all of EMD’s customers
- **Manufacturing Facility** – a drop-down list of all of EMD’s manufacturing facility (the starting point of the “total transport calculation”)
- **Distribution Center** – a drop-down list of all of EMD’s distribution centers; “direct to customer” is also an option, which would mean that the product is shipped direct from the manufacturing center to the customer
When each of these fields are filled in, the total “Distance Travelled per Leg (mi.)” is automatically calculated, mapped from a data table with distances between each of the relevant Customer/Manufacturing Facility/Distribution Center locations.

Once the customer information is filled in, the Product is selected from a drop-down list of all of EMD’s products, and the quantity to be shipped, in units. “Tote Preference” indicates whether the customer is willing to use a reusable tote or not (if you select “No Tote,” the Reusable Totes option will be grayed out in the Summary Table). There is also a toggle to select whether or not the Totes will require a return trip; our understanding is that typically the same tote is delivered to the customer and then returned to EMD empty, in which case both legs of the trip should factor into the distance travelled calculation. If, however, EMD is able to find a way to manage their logistics such that the tote doesn’t come all the way back to EMD’s facility empty, but instead is used for another shipment, perhaps from that customer to another customer, then the impact of the round-trip on economic costs and carbon footprint can be significantly reduced.

Once each of these inputs is filled in, a “Summary Table” will provide the relevant calculations for Total Cost and CO₂ Emissions (in lbs. of CO₂). The following contribute to the total cost calculation:

- **Initial Packaging (labor):** this is the labor cost required to package the product at the manufacturing facility
- **Repacking (labor):** if the product requires re-packaging at the distribution center, then this is the labor cost required for this activity (this is defaulted at 0 for reusable totes)
- **Transport:** this is the transport cost (labor + fuel surcharge), based on cost estimates from each of EMD’s distribution centers to various regions throughout the US
- **Waste Disposal:** this is the cost to dispose of the packaging waste, as measured in cost per lb., which varies depending on if the waste is cardboard or plastic (this is defaulted at 0 for reusable totes)

The CO₂ emissions calculation is based on total distance travelled, and was sourced from a carbon emissions transport calculator done previously by EMD. We’ve layered that calculator into the back tabs of this decision tool, in order to avoid duplicative effort. This tool will provide objective guidelines on the optimal packaging and shipping scenario for recurring or one-time customer orders. We have structured the tool to be as user friendly as possible, with simple and attribute-constrained input areas to maintain data integrity and standardization.
Summary Table

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Key Recommendations for Quantitative Decision Tool

Recommendation #1: Continue gathering data to improve robustness of the decision tool, and determine the ideal weights and thresholds of the variables. In order to be most effective, the decision tool requires a robust foundation of data to account for as many factors as possible that may influence packaging selection. If significant gaps exist in the data, the result of the tool may not reflect the impact of each variable sufficiently and therefore could suggest a packaging solution that is not ideal. In addition, the output of the model could depend on the weightings and/or thresholds that EMD assigns for each variable; for example, “Total Distance Traveled” could be specified to return a different value for multiple thresholds (<50 miles, <250 miles, <500 miles) or there could be a single mileage cutoff. EMD will have to experiment with these weights and thresholds in order to test the outputs of the model.

Recommendation #2: Use the tool to perform customer specific analysis, which can be used to generate buy-in from customers for different packaging solutions. For the CR team, the tool will give them some leverage in justifying the expansion of the reusable tote program in specific customer and/or product scenarios where it makes economic and/or environmental sense. Furthermore, if a customer asks for a reusable packaging solution, EMD can run the calculations and, if necessary, provide concrete reasoning as to why reusable packaging is or is not feasible. This will again put the bargaining power in EMD’s hands, demonstrating that the customer must be willing to share in the costs of implementing that program in order to swing the calculations in favor of reusable totes. This could lead to better end results for EMD, allowing them to quantify the implementation and on-going costs of their totes program for future customers.

Additional Recommendations for the CR Team at EMD

Recommendation #1: Create a cross-functional team that includes key stakeholders for a new packaging initiative (procurement, logistics, packaging engineers, sales, etc.). Our interviews revealed many individuals across EMD who are involved in some aspect of the packaging/shipment process, and believe that sustainability initiatives are important for the company to pursue. Given the complexity of EMD’s organization, a sustainability effort can only scale if it is a multi-functional effort, and if it is the priority of the company’s senior leadership. A cross-functional team of individuals from different departments at EMD could be appointed to work with the CR team to finalize and confirm the design of the sustainable packaging initiative. This would also ensure that there are program champions across departments and functional roles at EMD, and that knowledge sharing occurs
among the CR team and other groups. Importantly, because of the operational changes that such an initiative will inevitably require, this program will need to have the vocal and financial support and endorsement of EMD’s top leadership.

**Recommendation #2: Take advantage of shifts in the industry to move sustainability initiatives forward.** It is clear that customers are pushing for non-cardboard packaging, and in many cases are willing to pay a premium for reusable plastic totes. While the pilot program has challenges associated with cost and logistics, as the industry moves toward this type of packaging solution we believe that economies of scale will reduce some of these challenges. For example, if a critical mass of life sciences manufacturers like EMD are looking for similar packaging solutions, an off-the-shelf solution could become a possibility in the near future. If EMD can be a leader in coordinating other industry players - including competitors - to work together in moving toward reusable packaging then it could become a scalable solution. In the meantime, the CR team can work with the sales teams to better understand the customer needs and to use the reusable totes as a competitive differentiator.

**Recommendation #3: Connect with CR teams from other companies that have implemented a reusable packaging system to get a better understanding of how logistics issues were resolved.** While the challenges of a reusable packaging system will vary across industries, CR teams from other manufacturing companies could be a valuable resource for information and best practices. For EMD, the logistical challenge is the primary contributor to the increased environmental footprint of the reusable totes, so understanding if and how this issue can be resolved is critical for determining whether to move forward with adjusting the existing program or designing something entirely new.

**Recommendation #4: Identify and capitalize on incremental wins to generate momentum, but be mindful that a large sustainability initiative around packaging is likely to be “worse before better” from a return-on-investment (ROI) standpoint.** Sustainability initiatives across all industries often have difficulty gaining traction and buy-in if they are viewed as creating additional costs or providing low ROI. In order to generate momentum for larger projects, it is critical to identify incremental wins that can demonstrate a business case and keep the initiative moving forward. However, a large scale initiative such as a reusable packaging rollout will undoubtedly require significant investment up front and will provide returns that may be realized over a longer period than other types of projects. As a result, the CR team needs early wins to get the initiative moving but must also must manage expectations and provide a detailed analysis about the ROI time horizon.

**Conclusion**
EMD is operating in an industry where sustainability and reusability are not ingrained in the culture, and as a result it can be difficult to achieve buy-in from management, suppliers and customers that are focused on divergent priorities. However, the CR team at EMD has a rare opportunity to capitalize on the industry shift toward reusable packaging and make sustainability a key driver of innovation and customer satisfaction at EMD. Although the reusable totes program has significant economic and logistical challenges that are in turn having a negative impact on the environmental footprint of the program, we believe that adjustments to the current program and strong buy-in among customers could make this packaging option scalable. The Qualitative Scorecard and Quantitative Decision Tool are designed to help the CR team evaluate the totes program as well as any new type of packaging solution that may emerge,
with the ultimate goal of making EMD an industry leader in meeting the growing customer demand for reusable packaging.

**APPENDIX**

**MISCELLANEOUS NOTES**

Part of our criteria for which attributes to include in the customer-based Decisioning Tool was feasibility of data collection. Up to this point, there hasn’t been a concerted effort to aggregate and store the relevant customer, product, and transport logistics data in a system at EMD, however in our conversations with various people at the company we were told that the data does exist and/or would be simple to create. Since most of EMD’s business comes from a finite group of customers with whom they’ve done business for several years, a one-time data collection process should yield significant results and shouldn’t require much follow-on collection in the future.

**Trade-off between customer efficiency and sustainability**

- One of the key challenges with the reusable totes program is that what may be required to make the program environmentally sustainable may be at odds with what is required for lean and efficient manufacturing. EMD Millipore’s customers may want to minimize their inventory, for example, to keep costs low. They would therefore prefer to order smaller amounts more frequently, than to maximize the capacity of each shipment by ordering a lot, and keeping high inventory levels. From an environmental perspective, however, it would be preferable for EMD’s customers to order larger quantities fewer times. GSK, for example, was expanding its manufacturing but simultaneously wanted to reduce its warehouse facility. With limited storage space, therefore, it would be very difficult for GSK to order bulk shipping.

**Customers were not returning empty totes on time**

- Originally, the plan was for customers to send back empty totes each time new deliveries are being made to the facility. The logistics required for this, however, proved to be too complicated. Furthermore, the storage space required to hold the sufficient amount of safety stock of totes for the logistics to work seamlessly (in other words, no extra trips just to deliver empty totes) proved to be too large. Currently, the empty totes are returned to EMD Millipore after the customers are reminded to do so by EMD staff.
Problems with bulk shipping

- Some of EMD’s customers order relatively smaller quantities of numerous product types, and prefer for each of these types to be boxed in different containers. The CR team is currently in the process of evaluating these various pilot programs. Specifically, our team has been asked to assess the reusable tote packaging program, determine whether it would be appropriate for wider scale-up throughout the company, and if appropriate, recommend alternative sustainable packaging solutions.

- Economically, there are challenges with the current reusable totes program. Firstly, the upfront capital costs required to design a customizable tote. Each tote costs approximately [$figure from interview] to produce. Each tote was produced specifically for EMD Millipore and the specific product in question.

- The current cost structure between stakeholders is shared between the supplier, EMD Millipore and the customer. The customer pays an additional $6 per tote per shipment, based on the approximate value of the tote depreciated over 10 years.

- The last factor we evaluated from the current program and future packaging options is satisfaction of customer need. Currently this is the factor in which the current reusable tote program finds most success – EMD Millipore designed the whole program with the customers’ needs in mind. However, in this case we think that EMD Millipore’s focus on the needs hindered some of the other factors, including sustainability features. In future packaging designs, EMD Millipore should be mindful to weigh in all these various considerations with the demands of the customers for a program that can be scaled and replicated.

- During our first call with the EMD team, we learned about the reusable totes pilot program and received details about the environmental impact analysis that EMD had conducted to evaluate this program. While the customers involved in the pilot program were happy with the reusable totes solution, it was clear that from EMD’s perspective this solution was not scalable in its current form, due to cost- and logistics-related challenges. Furthermore, from a carbon emissions perspective the reusable totes were actually a worse solution due to the additional trips required to return the empty totes from the customer to EMD.

Qualitative Scorecard for Assessing Packaging Options

- During the course of our interviews with key stakeholders across EMD and at partner organizations such as Gusmer, we gathered a significant amount of information about various types of packaging solutions. This information covered a wide range of criteria, from environmental impact to customer satisfaction. However, there did not appear to be a “clear winner” across all the categories, and instead the information suggested that certain types of packaging solutions were better in certain categories and worse in others.

- Given the multiple packaging solutions and the wide range of evaluative criteria, it was clear that this was a complex problem that could benefit from a qualitative framework as a means of organizing the existing information. Creating this framework would allow EMD to visualize where each packaging solution ranked in each category relative to the other packaging solutions, and to
use this information to identify potential areas of improvement for a given packaging solution. Based on our weekly call with the EMD team as well as the supplementary interviews, we identified a list of existing and potential packaging solutions as well as the four most important criteria that factor into the decision of one type of packaging solution versus another:

List of Interviews and Roles

Sales Contacts

- **Claire Kazanjian** - Regional Sales Manager and Sustainability Lead for Process Solutions Business - she will have a good overall perspective of the business as well as what we will be doing to determine the next steps in defining a packaging solution for products. Also understands the customer's needs.
- **Greg Verni** - Global Key Accounts Manager - oversees the sales operations of some of MM's top customers in the Process Solutions space. Understands the demographics - locations of our customers and the types of volumes as well as some costs involved. Understands the customer's needs.
- **Peter Agneta** - Account Manager - GSK - Understands the details to how the current program works at GSK and some details around the workflow from receiving products to disposal at a typical customer site.

Clarification/Filtration Business - Product Focused

- **Jennifer DeKarski** - Product Manager, Clarification Products - Oversees the Depth Filter (PODs) business; understands the markets as well as customer needs; can be relied on for details on customers and some costing of the current totes program and other ways we ship these products.

Current Totes Program

- **Meghna Surampudi** - Demand Planning - Process Solutions - She currently handles the logistics with the current customer on totes. She understands many of the logistics not just of this program but also the distribution of all the products coming out of Gusmer.
- **Tom Janko** - Manager Procurement Sourcing Technical - Merck Group - works with the Gusmer partnership - he has a lot of details for the current Totes program and also costs - not just for totes, but distribution of the PODs and some other products.
- **Steve Nieland** - Gusmer Contact - Sustainability Lead (amongst other things!) - He has an extensive background in the amount of PODs used by customers, and the distribution channels we use. He also has some ideas around the metrics we might need to consider for the tool.

Packaging Design

- **Mike Oppenheim** - Packaging Design Engineer - Mike has extensive knowledge on the current totes program and also a wide array of packaging options from other areas of the business. He can assist in checking on the parameters/metrics needed for a modeling tool. He may also be able to assist with some of the distribution questions, logistics and other needs.

Outside of EMD Millipore

- Emiliano Barelli – Natura
- Christian Lim – Biogen