Redesigning the Ordinary: The Capabilities of Amazon Sioc In E-commerce Markets

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keywords: packaging, SIOC, LCA, sustailability, drop testing

Abstract

This paper will examine the efficacy of a redesigned packaging solution for The Ordinary skincare line of cosmetics, specialised for the Amazon SIOC program. This program aims to remove standardised Amazon overboxes from the supply chain, allowing vendors to ship their products as-is, with no further secondary packaging. This program ultimately aims to reduce overpackaging in a harsh e-commerce supply chain.

Testing in compliance with ISTA 6 and Amazon standards will be carried out with both a redesigned package and the current packaging solution. Comparisons will then be made to judge whether or not the redesign will be appropriate for the SIOC program. A comparative life cycle assessment (LCA) will then be conducted that will look into the endpoint impact categories of both packaging solutions from their raw material extraction and manufacturing stages of their life cycles. This paper aims to examine the potential of the SIOC program for sustainability initiatives in e-commerce supply chains through the reduction of standardised packaging and specialised solutions for each product.

Introduction

Ordering goods from Amazon comes with a few constants. Consumers all over the world know the iconic regular slotted container (RSC) that contains a plethora of items; from hardware to electronics to pet food, the RSC has stood the test of time in e-commerce supply chains. Today, Amazon is the fifth largest company globally based on market cap (Statista Research Department, 2022). Being arguably the most "global" organization, Amazon is intricately tracked; in 2021, the company shipped about 4.75 billion packages in the United States alone (Placek, 2022). That comes out to about 4.75 billion Amazon RSCs circulating throughout the supply

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chain, all of which must be manufactured, shipped, and disposed of. This raises many concerns regarding the environmental impact of their standardised packaging system; many products sold under Amazon come with their own primary packaging, so the redundancy of the RSC comes into question. Amazon may be able to ship some products as-is with no worry concerning packaging failure or product loss.

Enter Amazon SIOC (ships-in-own-container), a program under Amazon's Frustration-Free Packaging policy. SIOC allows for products to undergo a series of tests in order to remove the Amazon RSC during shipping, and have their product ship as-is. Through this program, over-packaging can be avoided leading to improved environmental outcomes. SIOC affiliates will also enjoy a reduction in Amazon chargebacks for packaging and transportation costs, giving them an incentive to participate (Amazon Network, 2021).

The cosmetics industry is growing with its global market expanding by 16% in 2022 (Petruzzi, 2023a). Skincare products make up a large chunk of the overall cosmetic market, comprising 41% of the global industry, and up to 60% in Asia and North America (Petruzzi, 2023b).

This paper will look at the viability of a line of cosmetic skincare products from The Ordinary for the Amazon SIOC program. Testing will be conducted on both a redesigned packaging solution intended for the SIOC program and the current packaging solution as a control. A short LCA will then be conducted to analyse impacts through the raw material extraction and manufacturing phases of both products to compare the effectiveness of the redesign to the current solution. The objective of this paper is to analyse and objectively evaluate the positive environmental impacts of the SIOC program, which aims to tackle unnecessary overpackaging in the e-commerce industry.

Literature Review

Amazon Type Classifications

Amazon's Frustration-Free-Packaging program has three levels of applications one may apply for. At Level 1, there is Frustration-Free-Packaging; any item that comes with its own primary package that is recyclable and easy-to-open is eligible (Amazon Network, 2021). Acceptance into this program will allow for a product to be shipped without an Amazon RSC as the product vendor will supply their own alternative. At Level 2, there is SIOC, which allows a product to be shipped without an Amazon overbox after undergoing testing according to ISTA Type 6 regulations (Amazon Network, 2021). On Level 3, there is Prep-Free Packaging which does not require any intervention from an Amazon Warehouse in order to ship as the vendor will handle all logistics themselves while continuing to use Amazon web services to sell their product (Amazon Network, 2021).

Life Cycle Assessment Resources

Life Cycle Assessment resources often come in the form of benchmarking materials for raw materials and distribution channels for e-commerce markets. These quantitative analyses help policymakers make decisions regarding environmental policy and sustainability moving forward (Civancik-Uslu et al., 2019). Notably, packaging for e-commerce is gaining increased traction from both the consumer market and academic community, with more journals and publications being produced year-over-year (Mucowska, 2021). There are five main areas of concern among the scientific community (Mucowska, 2021):

1. Carbon emissions
2. City logistics, management, and stakeholders
3. E-commerce
4. Crowdshipping and freight transport
5. Environmental impacts and cost efficiencies

All five of these categories make up the changing landscape of e-commerce and are going to be the focus of the LCA that will be conducted in this research.

The question of e-commerce chains versus retail chains still persists from a sustainability perspective. Sustainability metrics in shipping in bulk to where individual consumers must go themselves to pick up a product in a car-centric culture as opposed to shipping individual products to many consumers all at once is a subject of great debate. There is evidence to suggest that e-commerce distribution channels are actually more efficient in the environmental impacts measured, depending greatly on the use of air freight (Matthews et al., 2001). Air transportation, which is present in both retail and e-commerce chains, is an extremely large contributor to negatively
affecting environmental impacts. The most efficient method of reducing environmental impacts would be limiting air transit as much as possible. This would result in domestically or locally produced goods that can be shipped via land.

Methodology & Regulation

The product to be approved for Amazon SIOC is a glass cosmetic bottle with a liquid dropper cap. Testing for the control will be conducted with the original paperboard primary packaging placed inside the smallest standard-sized Amazon RSC with B-Flute double-wall corrugate. Testing for the redesign will be done through an upsized version of the original primary package consisting of B-Flute corrugate rather than the current paperboard.

In order to be approved for Amazon SIOC, the packaging must undergo a series of testing. This testing will analyse the package's protective and preservative properties via shock, humidity, compression, and leak tests (International Safe Transit

Association, 2018). For drop testing, packaging faces must be labelled properly. Package faces are to be labelled with different numbers that will be used to distinguish which faces, edges, and corners are to be drop-tested (Amazon Network, n.d).

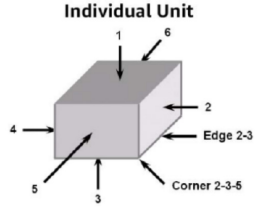


Figure 1: *Packaging face labelling standard (Amazon Network, n.d)*

Amazon Vendor Drop Testing

Amazon Vendor Drop Testing (AVD Test) is conducted for non-fragile products that weigh less than 50 lbs and have a total perimeter of less than 165" (Amazon Network, 2021). Success in passing the AVD Test would allow products to be shipped with its primary packaging in addition to the Amazon RSC over it; this is the testing parameter for Amazon's Tier 1 FPP program. Although the test subject is considered a fragile product and would require five samples for SIOC testing, the Amazon FPP program requires only three samples as the inclusion of an RSC would render the subject non-fragile (Amazon Network, 2021). The results from this testing will be the control group, with the current primary packaging placed in an RSC to simulate current distribution solutions. The RSC will be the Amazon 0A0 size, which measures 9.25" x 6.5" x 2.25"; it is the smallest RSC currently used in Amazon end-consumer shipping, which would be appropriate for this product (Awesomers, n.d). The current primary package measures 1.3" x 1.3" x 4.5".

The AVD Test has only one sequence of testing per sample (Amazon Network, n.d):

1. Shock drop test; 17 drops from varying heights and faces

Drop Number	Height	Orientation
1	18in	Edge 3-4
2	18in	Edge 3-6
3	18in	Edge 4-6
4	18in	Corner 3-4-6
5	18in	Corner 2-3-5
6	18in	Edge 2-3
7	18in	Edge 1-2
8	36in	Face 3
9	18in	Face 3
10	18in	Edge 3-4
11	18in	Edge 3-6
12	18in	Edge 1-5
13	18in	Corner 3-4-6
14	18in	Corner 1-2-6
15	18in	Corner 1-4-5
16	36in	Face 6
17	18in	Face 3

Table 1: *Amazon Vendor Shock Drop Testing Chart (Amazon Network, n.d).*

ISTA Type 6 Testing

Amazon classifies various testing methods and regulations based on product weight, product type, total package dimensions, and product fragility. Based on such criteria, the test subject, a cosmetic product that weighs less than 50 lbs, would fall under ISTA Type 6 Standards for the SIOC program testing (Amazon Network, 2021). ISTA Type 6 A Testing standards are applied to product applications to the SIOC program that weigh less than 50 lbs and have a total perimeter of less than 165". Additionally, if the test subject is 50% or more glass and would be considered a fragile product; five samples would be required for testing rather than one as required for non-fragile products (Amazon Network, 2021). This set of testing will be the experimental group, with the redesigned packaging solution being the test subject.

ISTA 6 Type A testing goes in the following sequence per sample (International Safe Transit Association, 2018):

1. Temperature and humidity testing at room ambient temperatures for 12 hours
2. An optional controlled temperature and humidity test for an additional 12 hours
3. Shock drop testing; 9 drops from varying heights and faces.
4. Vibration testing; random forces with and without top loads
5. Second shock drop test; 8 drops from varying heights and faces
6. Leak test; 8 hours

SHOCK - DROP			
Step	**Action**		
1	Follow the table below to determine the height and orientation for the first 9 drops.		
	Drop Number	**< 32 kg (70 lb)**	**Standard**
	1	460 mm (18 in)	Edge 3-4
	2	460 mm (18 in)	Edge 3-6
	3	460 mm (18 in)	Edge 4-6
	4	460 mm (18 in)	Corner 3-4-6
	5	460 mm (18 in)	Corner 2-3-5
	6	460 mm (18 in)	Edge 2-3
	7	460 mm (18 in)	Edge 1-2
	8	910 mm (36 in)	Face 3
	9	460 mm (18 in)	Face 3
2	Shock test is now complete. Go to TEST BLOCK 3 (Vibration Under Dynamic Load).		

Table 2: *ISTA 6 Type A first set of drop tests (International Safe Transit Association, 2018.).*

TEST SEQUENCE FOR PROJECT 6-Amazon.com

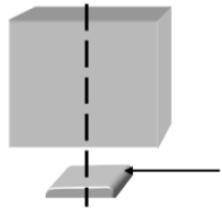
SHOCK - DROP			
STEP	**ACTION**		
1	Follow the table below to determine the height and orientation for the final set of 8 drops.		
	Drop Number	**Drop Height**	**Over Box Containing Test Specimen**
	10	460 mm (18 in)	Edge 3-4
	11	460 mm (18 in)	Edge 3-6
	12	460 mm (18 in)	Edge 1-5
	13	460 mm (18 in)	Corner 3-4-6
	14	460 mm (18 in)	Corner 1-2-6
	15	460 mm (18 in)	Corner 1-4-5
	16	910 mm (36 in)	Face 6 or Face 4 - Most critical or damage-prone flat orientation
	17	460 mm (18 in)	Face 3 on hazard
	For drop 17, the test specimen should strike the hazard midpoint across the longest dimension of the face and parallel to the shortest dimension of the face being impacted. The required drop distance is to the impact surface, not to the hazard. The diagram below shows this concept: 		

Table 3: *ISTA 6 Type A second set of drop tests (International Safe Transit Association, 2018.).*

Due to a lack of vibration testing equipment, Step 4 of testing must be skipped and will instead be replaced with a calculation of the compression strength of the redesigned package.

Products to be admitted into SIOC must have packaging that measures at least 6” x 4” x 0.375”, which the current packaging solution does not meet (Amazon Network, 2021). Therefore, the redesign will upsize this package in order to fit two products rather than one.

Failure Measures

All evaluations for drop testing are to be done via visual inspection. After each drop test, the package must be examined for any damage (Amazon Network, 2021). Any major damages include unsealed flaps, protrusions, box deformation, punctures, ruptures, or tears, and would lead to a failure to pass testing (Amazon Packaging Lab, 2018).

LCA Methodology

The LCA will take the weight from the redesign, and the combined weight of the RSC and current primary package. The life cycle inventory database to be used is ELCD. The corrugated material will be under the technology mix, production mix, 16.6% primary fibre, 83.4% recycled fibre, EU-25S inventory set. Recipe is the life cycle impact assessment method to be used. The results will ultimately yield the endpoint impact ratings for human health, ecosystem quality, climate change, and resources, allowing for a comparison of those metrics to be made between the current and redesigned packaging solution.

Results

Control Group Testing (Original Packaging Solution)

Sample #1 Shock Testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 no damage
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 no damage
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 no damage
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Sample #2 Shock Testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 no damage
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 no damage
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 Slight crease on primary package
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Sample #3 Shock Testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 no damage
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 no damage
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 Slight crease on primary package
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Experimental Group (Redesigned Packaging Solution)

All samples of the package were able to pass the ambient room temperature test. The corrugate and glass primary package experienced no visible damage or change in structure.

Sample #1 Shock Testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 no damage
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 Very slight flute pronunciation on face 3
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 no damage
14	18 in	Corner 1-2-6 Small crease on corner 1-2-6
15	18 in	Corner 1-4-5 no damage
16	35 in	Face 6 no damage
17	18 in	Face 3 no damage

Sample #2 Shock Testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 Very small creasing on corner 2-3-5
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 Small scuff mark on face 3
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 no damage
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Sample #3 Drop testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 Small crease on edge 3-4
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 Small scuff mark on corner 3-4-6
5	18 in	Corner 2-3-5 no damage
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 Flute pronunciation on face 3
9	18 in	Face 3 no damage
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 no damage
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Sample #4 Drop Testing:

Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 Small bend on corner 2-3-5
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 no damage
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 no damage
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Sample #5 Drop Testing:

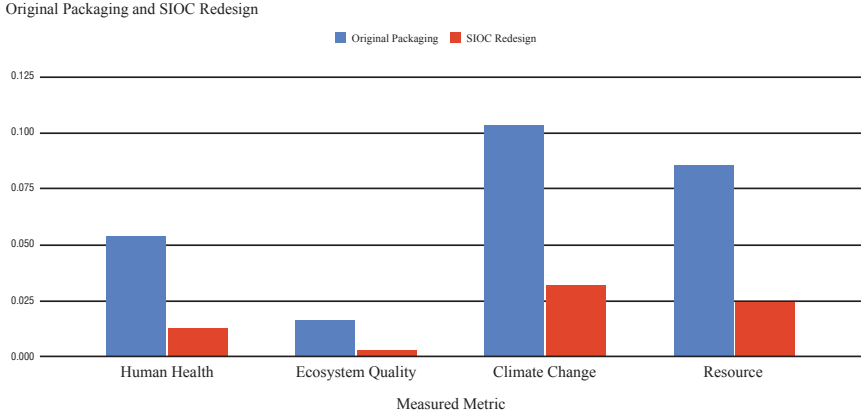
Drop #	*Height*	*Orientation Result*
1	18 in	Edge 3-4 no damage
2	18 in	Edge 3-6 no damage
3	18 in	Edge 4-6 no damage
4	18 in	Corner 3-4-6 no damage
5	18 in	Corner 2-3-5 Small bend on corner 2-3-5
6	18 in	Edge 2-3 no damage
7	18 in	Edge 1-2 no damage
8	36 in	Face 3 no damage
9	18 in	Face 3 no damage
10	18 in	Edge 3-4 no damage
11	18 in	Edge 3-6 no damage
12	18 in	Edge 1-5 no damage
13	18 in	Corner 3-4-6 no damage
14	18 in	Corner 1-2-6 no damage
15	18 in	Corner 1-4-5 no damage
16	36 in	Face 6 no damage
17	18 in	Face 3 no damage

Assuming standard US GMA 48”x40” pallet standards come with 45.5” height clearance on shelves, the maximum stackable amount is seven products per pallet. Each product plus packaging weighs 90 g in total. By taking into account the amount of weight the bottom product must support, that works out to 540 g. The B-Flute corrugated board must be able to withstand a maximum load per carton of 540 g.

The subsequent leak test showed no leaks or breakages in the glass primary package.

Life Cycle Analysis

	Measured Metric Original Packaging SIOC Redesign
Human Health	0.0529 0.0119
Ecosystem Quality	0.0163 0.00275
Climate Change	0.103 0.0316
Resource	0.0854 0.0249



Discussion (Analysis)

Control Group

The results from the control group testing line up with expectations. Since this configuration is very similar to what is being used in the current market, it can be deduced that in a real testing environment, these control samples would pass regulations and qualify for shipping. The small notes of damage such as creasing on corners are negligible; this damage is not considered a failure node for this line of testing and would still be viable.

Experimental Group

The testing from the experimental group would amount to a passing result. Of the five samples tested, only slight markings and creasings were present on the samples, none of which resulted in damage to the product and glass primary package. These damages would not qualify for a node of failure under ISTA Type 6 A testing regulations.

These results could be further improved; the corrugated board used in both the

experimental and control groups had been improperly stored and had dried out, leading to cracking along its crease lines before testing. In an ideal environment with properly stored material, there could be potential for even greater outcomes.

LCA Interpretation

Based on the given inputs, the endpoint data clearly indicates that a redesign would greatly improve measured impact areas through the raw material extraction and manufacturing stages of the product's life cycle. Human health factors improved by nearly 80%. Ecosystem quality impact decreased by nearly 85%. Climate change saw an improvement of about 66%. Resource usage decreased by about 80%. In addition, the redesigned package has a lower volume and lower package perimeter than even the smallest Amazon RSC, which would lead to improved outcomes in efficiency for e-commerce shipping and warehousing environments. Therefore, these benefits could
be even more exacerbated if more transit data was input. It is clear that skincare cosmetics packaging in e-commerce supply chains would greatly benefit from a redesigned package that would be eligible for the Amazon SIOC program.

Conclusion

This research aimed to test the efficacy of a specialised packaging redesign of The Ordinary line of skincare cosmetic products for the Amazon SIOC program. This redesign was then compared to the current packaging solution in e-commerce chains through an LCA that examined endpoint impacts through the raw material extraction and manufacturing stages of the product life cycle.

These are the 2 questions this research aimed to answer:

1. Would a redesign of fragile cosmetic packaging be viable in an e-commerce market, which is usually harsher on packages?

2. How viable is SIOC in improving environmental impact categories in comparison to current supply chain solutions?

Based on the findings, it can be concluded that this line of skincare cosmetic products would greatly benefit by repurposing their packaging solutions for the Amazon SIOC program. This redesign proved to be successful in withstanding the testing process, but it could be further improved with the use of properly stored material in a professional testing environment. The LCA showed great improvements for the redesign across endpoint impact categories, with a minimum improvement of 66% in each endpoint through the raw material and manufacturing stages of the product life cycle.

Ultimately, this research creates big implications for the potential of Amazon's SIOC program; the removal of standardised packaging into specialised solutions for each product can be greatly beneficial for supply chains and environmental metrics. These metrics could be even further improved upon; a full-scale LCA that examines all stages of the product life cycle could prove to have even larger impacts in favour of this redesign.

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Apendix

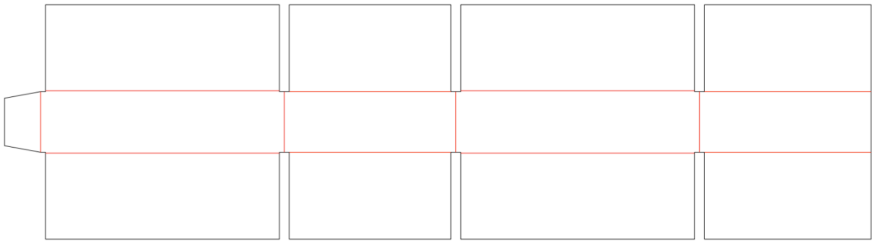

Figure A1: *The standard RSC dieline used in testing.*

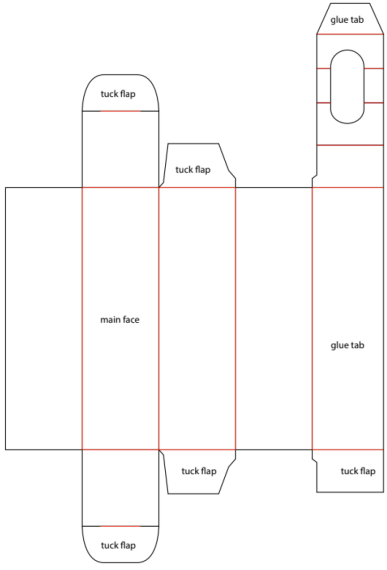

Figure A2: *The original primary package dieline.*

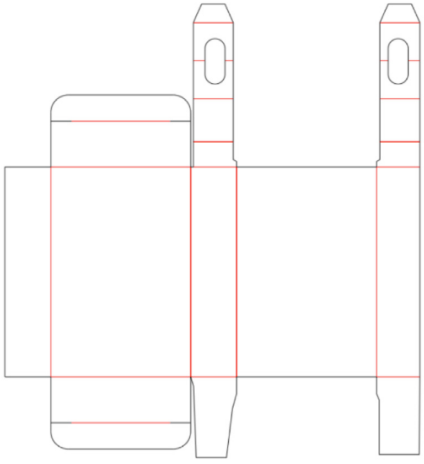

Figure A3: *The redesigned package dieline.*