



How Beauty and Personal Care Companies Extract Value from AI



Consumer Packaged Goods (CPG) companies, and those that sell into them, have been adopting AI as part of their product development process, and with good reason - it works! **2 of the top 5 CPG companies** use the Citrine Platform in their product development processes and we are now in a position to illustrate not only that it works technically, but how our customers are getting return on investment.

Higher Margins

- Lower cost of goods
- Lower R&D expenses per product
 - Fewer experiments
 - Better knowledge sharing
 - Gaining insights

Bigger Market Share

- First to market with better products
- Retail relationships
- Opening up new geographies

Lower Risk

- Responding to consumer trends and regulation
- Mitigating supply issues
- IP Management

Higher Margins

Lower cost of goods

When optimizing formulations the Citrine Platform is able to simultaneously optimize technical properties such as viscosity, sensory properties such as liking, and business considerations such as cost or number of ingredients.

Impact - based on average data from Beauty and Personal Care Companies

Citrine customers have lowered ingredient costs in skin care products by as much as **20%** within as few as two rounds of experiments.



Reduced Cost of Goods Sold

Costs of Goods Sold (2022, \$Million)	4000
Assuming ingredient costs as a % of COGS	40
Citrine's platform can be used on what % of product portfolio	25
Reduction in ingredient costs %	20
Increase in profit (\$Million)	80



Lower R&D Expenses Per Product

There are three aspects where the Citrine Platform has been shown to help improve product development efficiency.

- Fewer experiments

In traditional trial and error experimentation and Design of Experiment (DOE) methodologies, each experiment has an equal chance of either delivering you information about the domain you are working in and hitting target properties, or being a blow out that doesn't work. The Citrine Platform not only predicts the outcome of the experiment, but also the accuracy of its prediction. Researchers can therefore choose experiments with a high likelihood of success. Fewer experiments are therefore needed to hit targets, speeding up development time significantly. This is particularly important for tests that take a long time to perform or are expensive to carry out. In Beauty and Personal Care; photostability, microbiology, and emulsification tests are important and take hours or days to complete. Consumer panels are also expensive and time consuming. With the Citrine Platform our customers are confident that when they run these experiments they have a high likelihood of a successful outcome.

Impact - based on average data from Beauty and Personal Care Companies

Up to 80% reduction in R&D time.

Citrine's large CPG customers have reformulated to swap in bio-based ingredients in as little as a fifth of the standard development time

Reduced R&D Costs

R&D expenditure (2022, \$Million)

300

% fewer experiments

50

Experiments as % of R&D budget

30

Amount to reinvest in promising projects (\$ Million)

45



[Citrine] is a competitive advantage"

SVP of Business Services

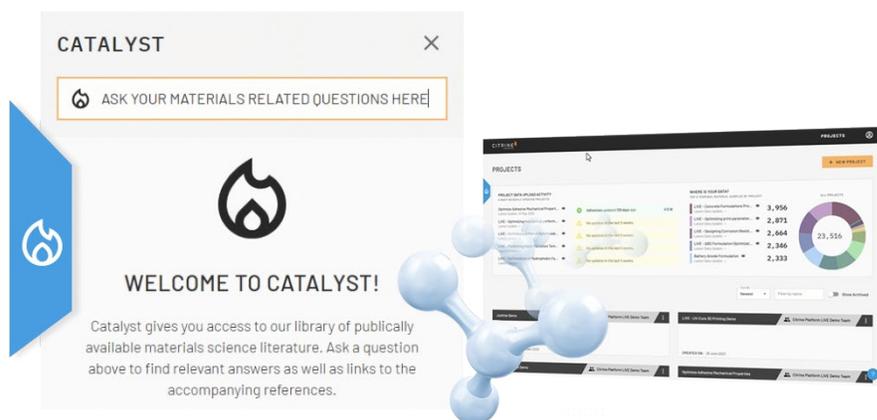
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- Better knowledge sharing

The second aspect of improving product development efficiency happens through better knowledge management. The Citrine Platform is designed to encourage domain knowledge integration. In our world data is precious, expensive to produce and certainly not "Big Data". By getting subject matter experts to guide the AI in the right direction, by integrating scientific knowledge of the domain and focussing in on candidate experiments that would result in a feasible product (from both a technical and business perspective), the Citrine Platform more quickly achieves success. Once datasets are set up with proper documentation of experimental conditions and AI models are created with embedded scientific equations etc., the models, data and search spaces are shareable assets that new team members can review and reuse, gaining the hard-won knowledge of your expert formulators.

The Citrine Platform also has CATALYST, a question answering app that can mine either a curated set of materials and Chemicals literature, or your own uploaded documents. It is a private, secure way to enable your researchers to ask questions and receive answers in plain language; quickly searching and summarizing disparate data sources.



“ To solve challenging problems in a formulation, some of it is intuition, but a lot of it is asking other experienced scientists for suggestions. If a platform has domain knowledge it can work as if you are “talking scientist to scientist”. Citrine does work that way. It makes suggestions and you can choose which ones to follow up on. It has the potential to be as powerful and comfortable to use as “Asking a question to an experienced scientist”.”

Product Developer

- Gaining Insights

The Citrine Platform is not a black box. In fact one of our users described it as a flashlight.

AI works by testing which inputs are related to which outputs in what way. It then uses this knowledge to predict unknown outputs based on inputs. Whether and how an input e.g., % of emollient in a cream, or in AI parlance “Feature” is thought to be related to an output e.g., viscosity, is listed in the Citrine Platform Feature Importance section. Here a domain expert can sense check the model and reassure themselves that the model is taking into account features that they think are important, but it also enables researchers to see factors that they have perhaps not considered before, or to rule out the importance of a feature, so that future experiments varying that input are not needed.

“ Citrine lets us solve problems with less work. It's like having a flashlight in a dark room.”

Product Developer

“ We understand our own laboratory more than before. It's fun to work in this way.”

Oliver, Technical Application Lead



Bigger Market Share

First to market with better products

As well as accelerating product development by reducing the number of experiments needed, the Citrine Platform helps researchers to confidently use completely new ingredients. Many of our customers are currently replacing petroleum derived ingredients with naturally derived ones. The Citrine Platform enables the development team to tag ingredients and enter their properties. It is then able to predict which new ingredients are going to best fit a formulation. Together with the ability to optimize more than one property at the same time, these aspects of the platform are enabling our customers to formulate superior products quickly.

Citrine's large CPG customers have reformulated not just single products but full lines, swapping in naturally-derived ingredients in as little as a fifth of the standard development time.



Retail relationships

High market share relies on tight relationships with retail partners. To get shelf space, it is important to meet their deadlines. As discussed above, the Citrine Platform accelerates development and makes that more likely. Another important aspect of the retail relationship is the need to give the retailer a reason to believe that the product will meet sales targets. Being able to visually show how the importance of certain ingredients affects consumer panel sensory tests or overall liking helps to convince retailers.

Opening up new geographies

By significantly reducing the cost of ingredients using the Citrine Platform, customers have been able to reduce price and maintain margin. This has enabled them to enter new geographic markets that were previously seen as limited by potential margins. Another customer was able to improve the

stability of a product, which meant that it could be more widely distributed, and maintained the quality feel needed to out-compete counterfeit products.

New Applications For Ingredients

Our customers use our platform to understand how the ingredients they produce impact the properties of their customer's products. One of our customers was able to prove that their ingredient would likely have a more positive affect than a rival's product. Another was able to see how an ingredient could be used in an adjacent market to the one they were already selling into.



Bigger Market Share (cont.)

Impact - based on average data from Beauty and Personal Care Companies

ROI Calculation for Increased Market Share

Annual Sales Group Total (in \$Million 2022)

15,000

% of product portfolio new or reformulated annually

20

**% increase in market share from getting to
market first with the best product**

4



Expected annual increase in revenue \$120 M

Lower Risk

Consumer trends and regulation

While it is much harder to quantify the impact of reducing risk, it is no less important. For Beauty and Personal Care companies, risk can come from several directions. Consumer sentiment can change rapidly, as has been seen with the "Clean Beauty" trend. Related to this is the introduction of regulations that can ban chemical ingredients, such as the EU Reach legislation and their CosIng database. When whole product classes need to be reformulated, such as waterproof makeup removing "forever chemicals", agility and speed is key. The Citrine Platform is currently being used on such projects.

Supply issues

Another risk is that of supply shocks, recently seen during the pandemic, but in an increasingly complex geopolitical environment, likely to become more common. The Citrine Platform can be used in two ways to guard against this risk. The first is to use the platform to find ingredients from different suppliers that perform in an equivalent way in formulations. In this way you can always have multiple suppliers. The second is to pivot quickly when issues occur. Once an AI model has been run and candidate formulations produced, you effectively have a list of hundreds of potential recipes. You can very quickly look up and test a formulation that hits similar target properties using different ingredients.



Lower Risk (cont.)

IP Management

The last risk that the Citrine Platform mitigates, is that of your company IP walking out of the building. As star employees retire or move to other companies, there is the risk of losing key knowledge permanently. The platform captures data in a way that it can be used by future researchers, with proper, standardized documentation of experimental conditions etc. Reducing the need to decipher handwriting in notebooks or finding and interpreting archived spreadsheets.

Summary

As our customers roll out the use of the Citrine Platform across their divisions, a clearer picture of the ultimate value the platform provides comes into focus. It is exciting to uncover use cases we had not anticipated and hear from users that are uncovering new knowledge in domains they have worked in for a long time. It is clear that the Citrine Platform's return on investment is huge in the Beauty and Personal Care space.

Contact us for both a demo of the platform and a more detailed, tailored return on investment calculation for your business.

