

ALLCHEMIST[®]

White Paper: Digital Future of Coatings Development Is Here By Bojan Buinac

Save Time, Money and Resources

A Cloud-Based, Outsourced Data Platform Creating a Streamlined, Sustainable Way Forward

Abstract

Recent research into the productivity and efficiency of research and development in the paints and coatings industry demonstrates that outsourcing data input and formulation experimentation to a platform - Allchemist reduces non-value-added work by up to 70%, while the throughput time of the entire product development process is reduced by 48%. This new, digitized, out





source approach to two key clogs in the cogs of paints and coatings R&D—data input on raw materials and laboratory experiments to test new products—dramatically streamlines the process, resulting in the saving of time, money, materials and, long-term, the environment. This paper examines this new phenomenon, which appears to show a revolutionary way forward towards increased profits for companies, happier and more productive staff, and a more sustainable future.

The paints and coatings industry, like so many of its sibling fields, functions, but does so in a manner that has been in place for decades. This means that there can be a great deal of inertia to shift to a potentially better modus operandi. This hesitancy to change approaches and to modernize is in part due to the continued success, financially and in terms of innovation, within the industry, which might make one take up the "if it isn't broken, don't fix it" stance. However, recent studies have shown that a way to keep the industry just as effective, if not more so,

while streamlining the research and development process, saving money and materials and better using the staff already on the payroll, is at hand.

This paper examines brand new study results that indicate this better way forward. The key shift is away from an old-fashioned approach to R&D, which is heavy on repetitive manual labor and administrative work. Instead, the "better mousetrap" appears to be the more modern solution of outsourcing data input and formulation experimentation to a cloud-based ICT (information-communication technology), which we might call a "technical enabler:" third-party software kept up-to-date with complete, usable data and safety information on thousands of raw materials. This database should be integrated into an application that allows for "virtual experimentation," which helps to narrow the number of actual, full-scale laboratory experiments needed to bring the right new product from concept to market, dramatically reducing non-value-added work.

48%

reduced throughput time

Tried and True, But Cumbersome and Costly

The traditional methods still in use by most paints and coatings firms do work, but they function with a lot of added expense, and at a cumbersome pace. To understand where research and development can be improved, one must first take a close look at the current status quo.

Data input is an unwanted but necessary task for R&D departments. Technical and safety data sheets for the raw materials that R&D departments will use to create new products must be regularly updated, with new materials added to ever-expanding databases. In the old days, technical and safety data sheets were physical papers or brochures mailed to companies, which then required staff to transcribe the key information into software, which was almost inevitably in-house, and in most cases was no more elaborate or hi-tech than spreadsheets. Fast-forward to the Internet era and most data sheets come in PDF form over email. This does not save all that much time, as the key information still needs to be typed into an in-house database spreadsheet, to make referencing guicker and easier. While some larger firms employ data transfer specialists, in the vast majority of cases, the duty of inputting information falls to R&D staff, many of whom have PhDs and find this basic data entry to be tedious and a less-than-ideal use of their time. It is also not a good allocation of resources, either financial or professional, to have highly-trained, well-paid great minds on your team relegated to spending hours transcribing data from PDFs

into spreadsheets. And yet, this is a normal process in most of the world's paints and coatings firms.

Once the information is available and in spreadsheets for the raw materials the R&D staff plan to use to develop a new product, it is time to begin experimenting. Calculations are made,



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formulations developed that they hope will meet the needs of the company in developing a new product. There is a lot of checking and cross-referencing required, checking the spreadsheets manually, and calculating various cross-chemical hazards and price points, to ensure that the new recipe will result in a product that not only works-fulfills the required product function-but is also safe and comes in at a cost that the marketing department feels that they can reliably sell.

Once the calculations are made and a variety of formulations are prepared, they are then tested in the laboratory, creating the product and its variations until what appears to be the optimal solution is reached. Once the R&D department comes up with what they think is a great product, they send the results to the marketing department. In many cases, the marketing team may like the product but say that it's too expensive, that they won't be able to sell enough units. So, the product goes back to

the lab with instructions to make it cheaper. Now a less expensive version is developed, and marketing is happy, so it's sent on to the safety department. There, it turns out that the chemical combination is too hazardous, so back it goes to the lab. An executive at a major European paint manufacturer estimates that some 80% of formulations at his company are re-formulations, so this vicious cycle tends to repeat.¹ These "back-and-forths" can take place over many rounds, over many weeks or even months.

What if there was a way to streamline these two time-and-energy-consuming steps? To eliminate entirely the need for data and safety information to be requested, gathered, entered and manually checked by R&D staff, freeing them to do what they do best, what they enjoy doing and what they are paid to do-develop new products? And what if the same solution could also be used to virtually experiment with new formulations for products, thereby catching potential issues, like hazards and price points, early on, in the virtual stage, saving time, money and materials by requiring fewer complete lab experiments and thus fewer back-and-forths between various departments?

¹Based on a conversation with the author, which the executive preferred to keep anonymous.

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Solutions Borrowed from Other Industries

Consider the way we used to select a hotel for our holidays. We would look up hotels in the phone book or write to them to request brochures outlining their offers, prices, benefits, location and more. We had to wait for the brochures to arrive. Then we would lay all the brochures out on the kitchen table, and start comparing. We wanted a double bedroom with an ocean view, that was cat-friendly, that served lunch, had on-site parking, and preferably had a swimming pool. It was hard to keep track of all the brochures, which kept falling off the table, and so we would take up a pencil and some lined paper, and

> draw up a makeshift chart, a proto-Excel document, listing the names of the hotels in one column, and the benefits, prices, features and negatives of each in other columns. Finally, we chose the best option, but by the time we did, so much time had passed that, when we called the hotel, it was fully booked! On to the next option...

That was the way this was done until the Internet simplified matters, cutting out phonebook search, the phone calls and the wait for brochures—that was all available online. But until technical enabler software was developed along the lines of Booking.com, Hotels.com or AirBnB, we still had to do the comparisons ourselves. Now thanks to cloud-based data management outsourced to a technical enabler, websites like Booking.com do all the work for us. We just input what we were after—a hotel in this city, with this price range and with features X, Y and Z—and the options appear on our screen. A huge amount of time is saved for us, the users of the data. This system also benefits the suppliers-in this case, the hotels-because in exchange for the relatively straightforward work of uploading their data to the technical enabler, users can find these suppliers more easily. Everyone benefits.

The paints and coatings industry, along with innumerable other major parallel industries the world over, is still using the old-fashioned method, the equivalent of the phonebook and pencil approach to choosing a hotel to book. The R&D methods at play involve far too much time and value

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lost to fiddly data input, requesting data sheets on new chemicals, receiving them as brochures or PDFs, and laboriously typing the data into in-house software for in-house use. There is a similar old-fashioned approach to laboratory testing, wherein R&D departments go through the lab testing process for innumerable iterations of a new product that will not be used in the end, largely because they do not meet the preferred price point or are deemed too hazardous for the market.

Until now, there has been no other viable option. R&D departments continue to slog on, functioning and producing, but with a significant loss, because there is so much non-value-added time at play in this current system, in which the gears grind only slowly and incrementally forward.

Several new studies, so new that they have been accepted but not yet published*, demonstrate that taking the technical enabler approach of outsourcing data input to a single, platform - Allchemist can radically reduce non-value-added time, and greatly improve and streamline productivity ("Industry 4.0: Opportunities for Paints and Coatings R&D Process Improvement," DSI Conference 2019). Not only that, but this software revolution can offer the same streamlining and optimizing to the pre-lab experimentation phase, eliminating costly and time-consuming lab tests that can be shown to be unnecessary through virtual experimentation via modelling software. The result is fewer, more efficacious lab tests, thereby getting to end results-new products-more quickly, all the while saving money, time and materials, which is ultimately beneficial not only to the company, the morale of staff, and the bottom line, but also to the environment, as less material and energy is used in complete lab experiments ("Reduced Environmental Pollution in the Process of Coating Development by the Use of Information Technology," 38th International Conference on Organizational Science Development, Ecosystem of Organizations in the Digital Age 2019 accepted paper, as yet unpublished). It makes creating a new paints and coatings product more akin to choosing a hotel on Booking.com.

* Since then a study has been published; "Digitalizing the Paints and Coatings Development Process" by Tomaž Kern, Eva Krhač, Marjan Senegačnik and Benjamin Urh, August 2019 (accessible online at https://www.mdpi.com/515792).



New Case Studies

A 2018 study used a new technical enabler to test comparable efficiencies in the experience of formulators of paints and coatings, first using the traditional system in two steps, data acquisition and formulation, and then modelling what the process would look like using Allchemist.²

² "Research into Digital Transformation Eligibility in the Field of Paints and Coatings Development." University of Maribor, Faculty of Organizational Sciences, Laboratory of Enterprise Engineering, 2018.



New Case Studies

This research project divided the execution of all R&D activities into a timeline: waiting time (twt), orientation time (tot), processing time (tpt). Combining these categories resulted in total activity throughput time.

	activity 1			activity 2			activity 3		
	tof, 1	tpf, 1	twr, 1	tof, 2	tpf, 2	twf, 2	tof, 3	tpf, 3	twf, 3
time									
	tpa, 1			tpa, 2			tpa, 3		
	process through put time $t_{TP} = \sum (t_{PA, 1} + t_{WT, I})$								

Figure 1: Structure of process throughput time (T. Ljubič, "Operational Management of Production," Modern Organization, Kranj, 2006)

Product development was likewise subdivided into: creating a new product idea, marketing analysis of existing products, searching for suitable binders, study of binders properties, searching for pigments, searching for additives, searching for solvents, searching for fillers, formulation (modified) formulations, ordering samples, product laboratory testing, product parameters measurement, product hazard identification, product price calculating, internal validation, external validation, preparation of documentation draft and creating documentation.



Figure 2: The value-added diagram (VAD) of the existing development process

For each category, the researchers asked the three case study companies involved in the study to predict the expected time, optimistic time, most probable time and pessimistic time for completing the phase in question. These phases, like "waiting time after activity," are often overlooked but are crucial to the overall timeline. Not only active time but waiting time between actions is a component of the process: for instance, if results are sent to a colleague, then one must wait until the colleague receives the results, takes the time to examine them, writes up a response and sends the response back. What may map out as, say, 9 hours of total work to complete a project may be 9 hours of active work, but when one integrates delays and waiting between actions, then 9 hours can easily transform into days or even weeks.

In this study, a total of 18 activities were tested via both static and dynamic process testing at three companies of

varying size, all in the paints and coatings field and all based in Europe.³ Simulations were carried out over 231 days, 8 hours a day—the total number of working days and hours in one calendar year.

Each company functioned as a case

study, and the researchers asked R&D department employees at each company to keep track of the time they took to complete research and development activities using the traditional methods employed by each company, and then while using an outsourced, cloud-based technical enabler application. ⁴ This data was then sent to the researchers for analysis.

³ It must be acknowledged that this is a small test range, but one has to start somewhere, and the availability of technical enabler software solutions is so new that this represents the very first viable study and features such superlative results that it will surely inspire many future studies.

⁴ The technical enabler application used by the study in question was Allchemist, a prototype developed by the author's firm, Bens Consulting d.o.o. More information is available at https://www.allchemist.net/.



Data Acquisition – Traditional Methods

As has been discussed, the traditional method of data acquisition involved requesting data on raw materials from chemical producers, receiving it in PDF form and inputting the data into in-house software. This was largely undertaken by R&D formulators, most of whom have advanced degrees and find this sort of mechanical, secretarial data-entry work to be frustrating, keeping them away from the important work they are paid to do, which is to develop new products. It does not make sense to pay a PhD to do data entry. Not only is it not a good use of staff, but it is not good for morale, and results in annoyed staff who will not do as good a job at the data entry, since they feel it is a "waste of their time," and will also have less time to dedicate to their crucial work: development.



Data Acquisition – Traditional Methods

12 Data Acquisition – New Method

In lieu of the old-fashioned approach, this study asked the companies involved to estimate what a timeline for development would look like if they used a technical enabler, Allchemist came in the form of an independently-run, cloud-based application. This application already contained data, pricing and safety information on over 2000 of the most-frequently-used raw materials in the paints



and coatings industry and this was updated on a regular basis by dedicated, trained staff, keeping tabs on new information about existing products (such as changes in properties or parameters), and also adding new raw materials to this ever-expanding database.

The result of this predictive modelling approach to how the companies' operational procedure would play out using such an application was that the companies involved in this study did not need to dedicate a single moment to data entry and acquisition. They were given access to the technical enabler's application and simply logged on. None of the companies involved in the study needed access to data on raw materials that were not already in the technical enabler's database.

Lab Formulation and Testing – Traditional Method

virtually.

Laboratory testing is the slowest of all the necessary activities among the processes in paints and coatings research and development. But it is an essential step, as no new product can be launched without lab tests. The key is to locate weak points in the formulation and testing process, to see if aspects can be streamlined or eliminated, in order to improve the overall process of bringing new products to light.

The research noted that unnecessary laboratory tests were the most cumbersome aspect of the current system. Functionality testing (for instance, is a new paint the right color) is necessary, but other details (price, hazards, environmental friendliness) could be determined in Allchemist. By working in a "virtual formulator" that was part of the technical enabler's application, companies were able eliminate lab tests that, a

priori, were not going to work or produce the end result that was required. Paints and coatings companies are used to running numerous lab tests, only to come up with one that produces the desired result and opens up a new product. In order to shift to using a virtual formulator, R&D staff must have access to a functioning, programmed, software-enabled database, as opposed to the passive spreadsheets employed by most companies to keep track of raw material data. They need a broad database that is usable (which means that it cannot be in PDF or Excel formats), in which they can play experiments out

Lab Formulation and Testing – New Method

Experimenting using the Allchemist virtual formulator narrows the breadth of lab tests that need to be done physically, functioning like a funnel system. One begins with many different ideas of how to solve a problem and come up with a new product. Rather than seeing out complete lab testing of many of these ideas, formulations were mapped out in the virtual formulator. This software kept regular track of the total cost of the raw materials going into the recipe and flagged any hazardous interactions of selected materials and any environmental warnings. Thus, right in the virtual formulator, R&D staff could "play" with different formulations and immediately see which would not work from a pricing, hazards and environmental perspective. This process does not eliminate lab tests, but it results in running fewer complete lab tests, and those that are run have a greater likelihood of being useful to the creation of the end product.

14 Results of Testing

Though the scale of this study ("Research of Digital Transformation Eligibility in the Field of Paints and Coatings Development." University of Maribor, Faculty of Organizational Sciences, Laboratory of Enterprise Engineering, 2018) was small, it showed dramatic results in companies of a variety of sizes, providing optimism for this new approach to paints and coatings R&D, and paving the way for new, more expansive studies. Initial results show the reduction of throughput time of the R&D process of an entire newly-developed product by 48%. There was a 70% shorter throughput time for the execution of R&D activities where the technical enabler has a clear, direct result (such as in the virtual formulation experimentation). There was even more than 7% reduction in throughput time for activities for which the technical enabler does not have a clear, direct role, such as in the actual lab testing. This suggests that this streamlined approach not only speeds up the process at the obvious points, but also results in what might be called a "streamlining culture" that positively effects all aspects of the R&D process, even those not directly benefitting from the technical enabler application.



Figure 3: Comparison of the existing new product development process Gantt chart (orange) and modified (renewed) process (blue)

Enabling a Digital R&D Future

Smart 4.0 is all about internal optimization and digitalization. But if the focus can turn to external optimization that, through its use, can lead to internal optimization, then it is less work for each firm internally, with firms instead reaping the benefits of the remote external optimization tool - Allchemist.

There is a knowledge sharing advantage to using a platform that can make suggestions on behalf of the formulator. Allchemist is programmed to recognize the sort of product that a formulator is trying to develop, and suggests options for raw materials, much in the way that Booking.com suggests activities that the platform thinks a customer might like, based on their search preferences. It can list suitable materials based on detailed quantitative and qualitative criteria input by the formulator. In colloquial terms, this means that the human formulator

"tells" the application what he or she is looking for or hoping to achieve and, within seconds, the application suggests materials that meet the input criteria. In an informal experiment in December 2017, a technical support staff member at a major paint company was asked to recommend raw materials for a new formulation, while the same question was asked of the technical enabler software. The technical support staff member, off the top of his head, came up with three viable chemical options to achieve the desired goal of the new formulation. The technical enabler came up with the same three options, plus two others. The staff member concurred that the additional two, which he hadn't initially thought of, would both work.⁵

⁵ The staff member in question preferred to keep this informal study anonymous, but it is a good indication that a formal version of such a study would bear interesting fruit.

This anecdote goes to show that, while software will never replace human formulators, it can be a useful tool to ease their workload, and occasionally make practical suggestions and indicate potential directions that might otherwise slip through someone's mind.

The key to Allchemist, cloud-based technical enabler application approach working long-term is for companies to voluntarily enter their information about raw materials regularly into the online system, saving the step of creating and disseminating PDFs that each potential user or buyer has to then re-enter into their private systems. In a single step, producers of raw materials can upload their data and safety information to a single, universal application that all users of those raw materials can access. This will save countless man-hours in all steps of chain: for producers of raw materials and for users of raw materials, even for the suppliers themselves. As in the Booking.com analogy, there is also a promotional benefit for raw materials suppliers, whose product will be found by users of the technical enabler software, as outlined in recent papers from McKinsey & Company, ⁶ Gartner, ⁷ and DKE. ⁸ Companies that once imagined the promotion of their chemical ingredients in terms of salesmen driving around with brochures, or the half-way digital equivalent of emailing PDFs around, can now see the potential for a better way forward. The technical enabler platform not only helps R&D departments, but also dramatically reduces the burden on the supplier's technical support team. The process can be radically streamlined.

⁶ "Demystifying Digital Marketing and Sales in the Chemical Industry" by Soren Jakobsen, Kedar Naik, Nikolaus Raberger and Georg Winkler, February 2017 (accessible online at https://www.mckinsey.com/industries/chemicals/our-insights/demystifying-digital-marketing-and-sales-in-the-chemical-industry).

⁷ "Gartner: The 2019 CIO Agenda. Securing a New Foundation for Digital Business, Gartner Inc., 2018" (https://www.gartner.com/en)

⁸ "DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE: German Standardization Roadmap," Industrie 4.0, Frankfurt, 2018" (https://www.din.de)

www.allchemist.net

Conclusion

This paper has presented brand new data that demonstrates that shifting to an outsourced, cloud-based technical enabler - Allchemist, in the form of a database application that allow for virtual experimentation, reduces non-value-added work by reducing throughput time for R&D departments in the paints and coatings industry up to 70%, while the throughput time for conceiving and launching an entire new product is reduced by 48%. This new, digitized, outsourced approach to two key clogs in the cogs of paints and coatings R&D—data input on raw materials and laboratory experiments to test new products—dramatically streamlines the process, resulting in the saving of time, money, materials and, long-term, the environment. These new studies indicate that this new phenomenon shows a revolutionary way forward towards increased profits for companies, happier and more productive staff, and a more sustainable future.



About the author

Bojan is the driving force and the brains behind Allchemist. Since the establishment of BENS Consulting in 1996, he has actively cooperated and formed the field of chemical regulatory affairs. Recognizing the inefficiency of gathering and processing material data in R&D, and often outdated ways of handling the chemical documentation, Bojan invented the first digital solution for every part involved in the paint and coatings industry.

He presented this white paper at the European Coatings Show Conference 2019.

