Digitalization Facilitating the Move of Chemical Companies into Services

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At the heart of many relationships between producers of chemicals and their customers, there is a fundamental contradiction. Chemical companies, typically getting paid by the amount of product they sell, aiming to sell as much product as possible. On the other hand, customers ideally want to buy as little as necessary, as long as a certain function is delivered by the chemical.

Mostly, this contradiction is managed but not overcome by tools such as specifications, either of the materials themselves (e.g., purity) or their application properties (e.g., bond strength of an adhesive). Customers specify a certain quality as a minimum requirement, thus limiting the option of the supplier to sell more of their products while lowering the quality.

However, this mechanism only works in one direction. Specifically, there is no immediate incentive for a chemical producer to improve the quality of its products in a way that decreases overall demand, even if such an improvement could bring substantial overall benefits from a perspective of value creation at the chemicals producer and the client combined.

To give a specific example, a protective coatings producer may have found a way to improve the properties of his product to provide the same protective properties with half of the amount of coating utilized. What is its incentive to share this improvement with his customer?

Of course, in the long run, the producer will probably be forced to do so due to the competitive nature of the market. In the short term, value pricing may be an option – arguing to the client that the producer should be allowed to double the price of its product as the benefit derived from it also doubles. However, it is far from certain clients will accept this rationale.

Another option – the one discussed in this paper – is to change from selling physical products (chemicals) to selling services (essentially the provision of certain properties). Taking our example above, this would mean our chemicals producer first agrees with the client to get paid by the amount of surface protected (and may even do the application of the coating itself), and only then switches to the new, improved formulation.

This idea is of course not new – it has been used in the past, though never to the extent forecast by some of its advocates. However, there is reason to believe that digitalization of the industrial world (call it Industry 4.0 if you want) will help accelerate the adaptation of service models in the chemical industry.

Before going into that, let us first mention some examples of service models already established in the chemical industry.

- An Indonesian newspaper company, Wijeya Newspapers, pays its ink supplier General Ink not by the amount of ink used but by the number of newspapers printed, giving the supplier an incentive to reduce the amount of ink used
- In automotive OEM, BASF Coatings is no longer paid by the amount of coating used but rather by the number and area of vehicles coated
- At a Uganda beverage producer, Diversey, the American company providing lubrication needed for the conveyor belts used, is not paid by the amount of chemicals sold but by the amount of beverage bottled
- Henkel became a supplier to Serbian confectionary company, Bambi Banat, by suggesting an improved packaging process based on a new adhesive, and is now paid per box glued rather than by amount of adhesive

As these examples show, the concept works particularly well for specialty chemicals, as these are by definition bought for the properties they deliver to a product or process, and thus it is relatively straightforward to put the payment on a performance basis. In Fig. 1, stage 2 of the development of services in the chemical industry has now been reached.

The spread of digitalization does not fundamentally change the concept of delivering services and/or performance instead

of physical amounts of chemicals (stage 3 in Fig. 1). However, it allows the concept to be extended to areas in which performance would have been difficult to quantify earlier due to the complexity and amount of data involved. Potential examples include a number of specialty chemicals areas.

Catalysts: These chemicals have a huge impact on the economics of the chemical processes they are involved in via a multitude of parameters such as yield, temperature/energy requirement, product ratio, reactor service life, emission levels etc. Optimization of a catalyst with regard to individual parameters only may lead to a suboptimal total result. However, using the data on all the parameters above (captured via sensors at the reactor or elsewhere) allows for an overall optimization that takes the costs of the individual aspects into consideration. Catalyst providers can thus be remunerated according to the overall value created by their chemicals despite the high complexity of such calculations.

Coatings: The performance-based models already in place and discussed above (e.g., in automotive) can be extended and fine-tuned based on the substantially increased amount of process data available, and the ability to process such data. For example, rather than just being paid for surface area protected, the compensation may also be based on factors such as consistency of coatings film thickness or level of residual monomer in the finalized coating.

Industrial cleaners: In industrial production, cleanliness often is an important parameter influencing the quality of the final product. Producers of such cleaners thus may be remunerated based on the achievement of certain levels of cleanliness, and be punished for any aberrations based on continuous monitoring data of the relevant parameters. However, this will of course mean a substantial expansion of the business model as in a case that is as application sensitive as cleaning, it would mean the chemicals producer also has to take over the actual cleaning process.

Oil field chemicals: Digitalization makes it feasible for a provider of oil field chemicals to be remunerated by the amount of oil produced rather than by the amount of chemicals provided, as geological characteristics of the local situation can be captured and taken into account when evaluating the performance of said chemicals.

Rubber process chemicals: As tire

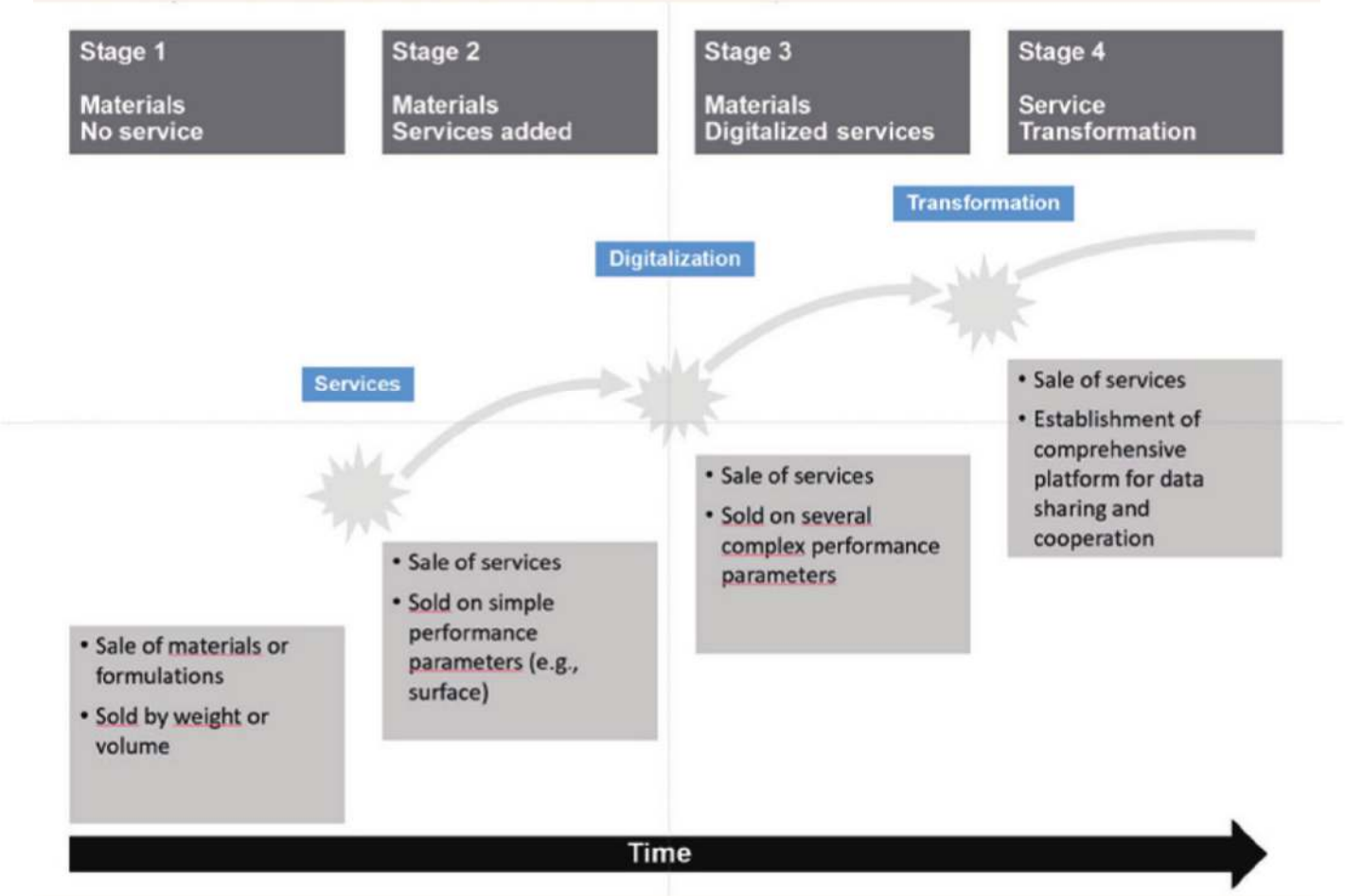

Fig. 1: Development of services in the chemical industry

manufacturers such as Michelin move towards managing all tire-related items of their customers (e.g., industrial fleets), they gain significant insights into the durability of their individual tire formulations. This data can in turn be utilized to quantify the performance and remuneration of the suppliers of tire chemicals.

Water treatment: In this segment, the value creation nowadays primarily lies in providing solutions, i.e., offering water treatment for cities, industrial parks etc. rather than selling individual chemicals or formulations to separate water treatment plants. Using the wealth of data available in, e.g., a chemical park on the individual waste streams, the degree of treatment, the amount of energy utilized, the amount of emissions after the treatment etc. will allow companies offering water treatment (such as Veolia) to be paid exactly by their performance, aligning incentives despite the complexity of parameters.

The most exciting but also most challenging step is one for chemical companies to subject their overall business model to a service transformation, as shown in stage 4 of Fig. 1. Such an overall service transformation currently has not been tried by chemical companies. However, there are examples from other industries for such a transformation.

Airbus has launched an aviation data platform, "Skywise", in collaboration with Palantir Technologies, aiming at bringing together OEMs, carriers and suppliers. Skywise provides all users with one single access point to their enriched data by bringing together to aviation data from multiple sources across the industry into one secure cloud-based platform. Examples of activities already being done on the platform by several airlines include events tracking and resolution, turnaround-time analysis, operations analytics, predictive maintenance, reliability analysis, benchmarking, and maintenance decision support.

Siemens created MindSphere, a comprehensive data hosting platform that allows to connect devices and assets from a manufacturer's shop floor and to securely store operational data. By launching MindSphere, Siemens aims at increasing the sales of its portfolio, which includes devices (e.g. MindConnect Nano, MindConnect IOT 2040 to connect assets to MindSphere), software (Siemens' industrial software, e.g. Simatic IT for connecting machine data on the shop floor), and data-based services (such as Machine Tool Analytics, Energy Analytics etc.).

How could a comparable service look like for a chemical company wanting to be fully transformed into a similar type of company? Obviously, the complex world of chemical processes and supply chains with their vast amounts of data should also offer substantial benefits of providing data integration. More specifically, a chemical company wishing to take this direction may establish a platform open to suppliers, customers, end-users and possibly even competitors. Such a platform can record, consolidate and share all process- and product-related data along the value chain. This will reduce communication costs, enhance transparency and therefore support decision-making of all participants. It may also bring new opportunities through modelling, simulation and high-performance computing with the participation of multiple parties.

More specific benefits delivered by such a platform may include

- Facilitation of R&D cooperation between, e.g., established chemical companies, universities and startups
- Remote monitoring of client's usage of chemical products accompanied by instructions and training on how to improve the usage
- Better handling of shortages in materials by providing a complete overview of the amount and location of material available
- Utilization of data from production processes at the client to improve functional materials supplied to them. For example, a company selling catalysts to another chemical producer may make minor variations of their catalysts, get the process data (e.g., yield) via the platform and use this data to gradually optimize the catalyst
- Utilization of spare computer capacity at any of the participants to do complex chemical calculations, e.g., of polymer structures.

The platform operator may even earn income from selling data obtained via the platform to competitors and other interested parties.

However, chemical companies considering the switch to a business model based on the performance of their products at their clients should be aware that this will require additional changes apart from just adapting a different payment scheme. Such a switch should be preceded by a detailed analysis including financial modeling. It will also require changes in the culture and attitude of the company. Overall, adopting a remuneration based on performance at the client needs to be based on a thorough understanding of the client's processes. Communication and exchange with the client will need to be extended, which may be straightforward for some employees but difficult for researchers who prefer to optimize their products in isolation. While such staff can still be valuable, they need to be linked to the client via suitable functions, which may have to be added to the organization.

Despite these difficulties, switching to such a performance-based model offers two key advantages and thus should be the subject of serious consideration. One is the much closer customer relationship created via performance-based payment, as this requires a very good understanding of the customer's processes which cannot be easily replicated by a competitor. The other is that fundamentally, as the incentives between customer and chemicals producer are better aligned in this model, there should be additional overall economic benefit. In other words, more profit to share between the two parties involved. ■